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Electrical World

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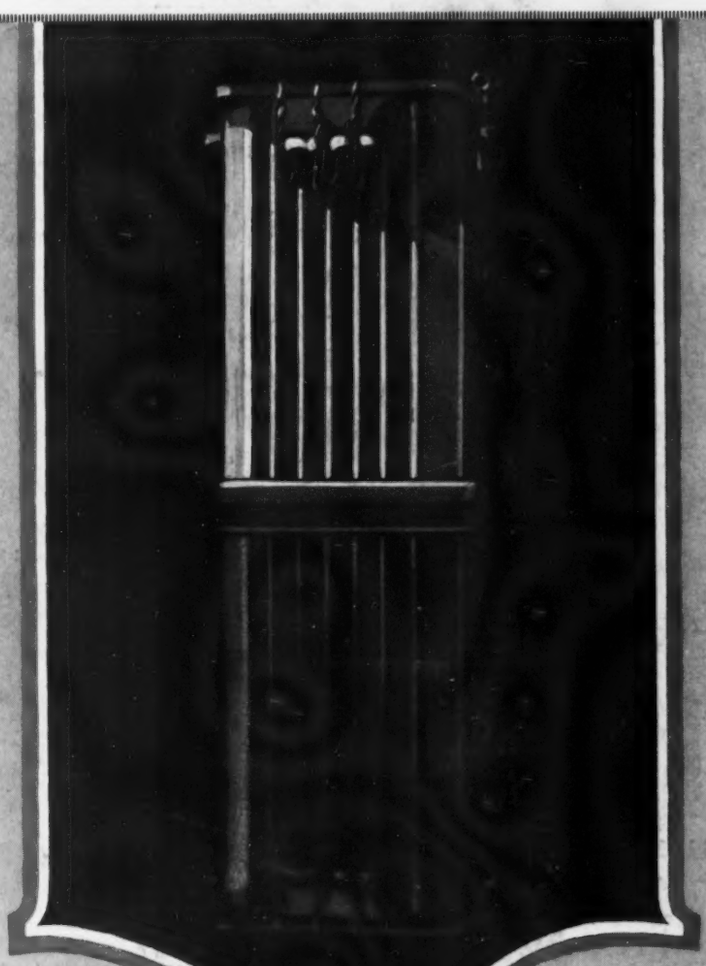

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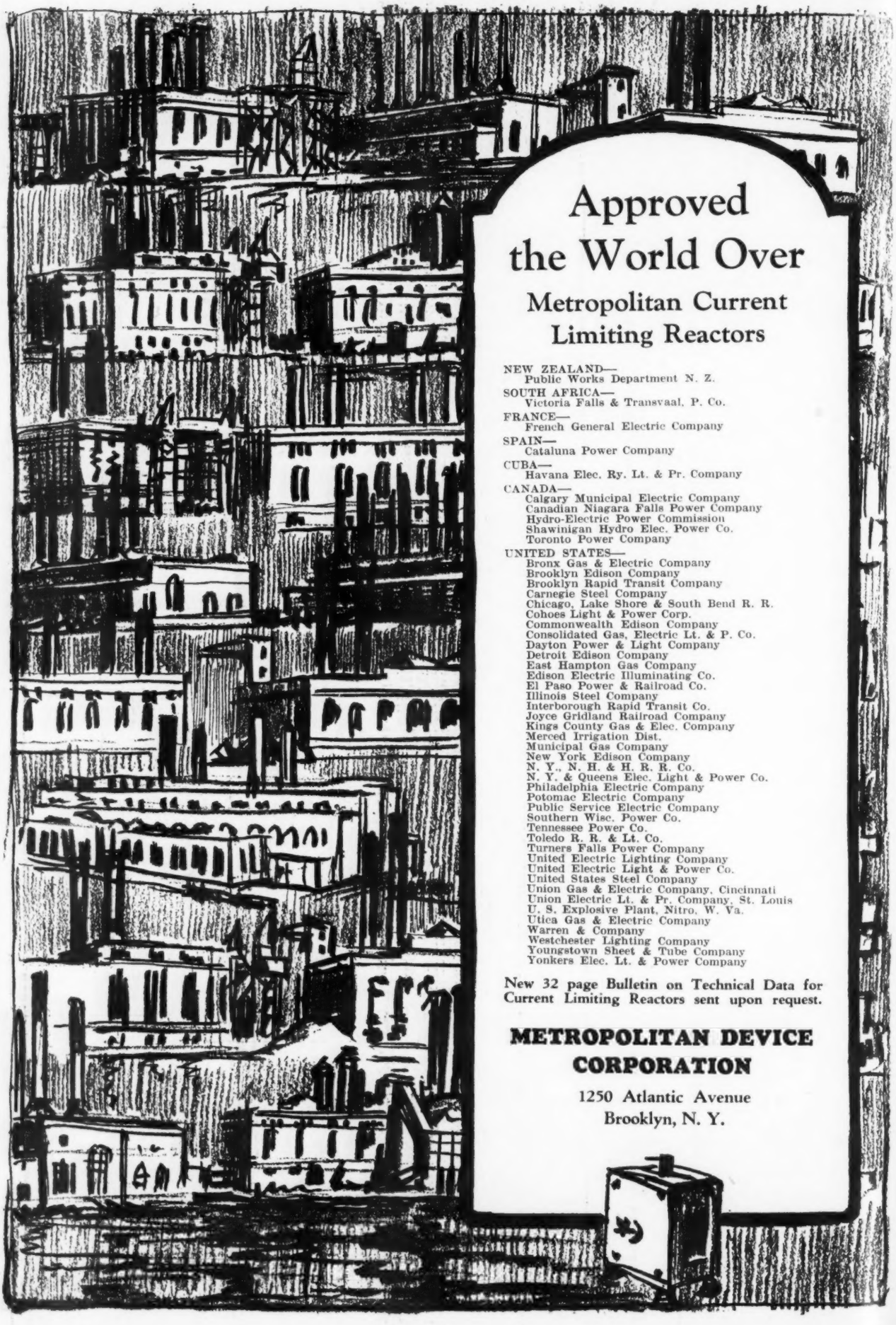

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New 32 page Bulletin on Technical Data for Current Limiting Reactors sent upon request.

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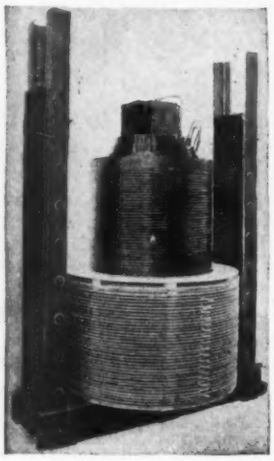
¾ of a Million Volts

That's What We Have in this laboratory



The "Insides" of a 750,000 Volt Transformer

A Well Known Engineer Writes As Follows:

"I wish to comment on your monthly magazine dated December 15, especially on the Aerial Mapping and Survey by Aeroplane article.

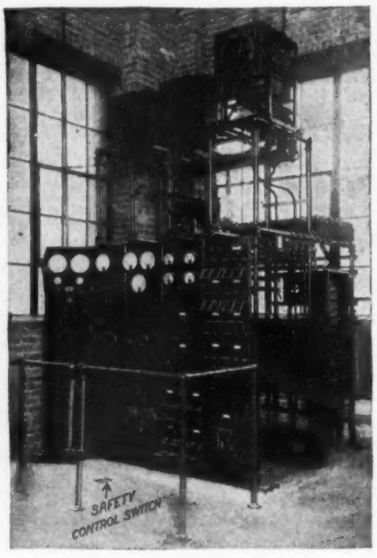
Also, you might be interested in my reaction to the emphasis you have been placing on your 750,000 volt testing laboratory. I was quite surprised to know that you are as elaborately equipped for testing as you are and am favorably impressed with the influence this must have on the quality of your equipment."

One of the 1,000 M.M. Testing Spheres

Method of Control

A specially designed 2000-volt 60 cycle synchronous motor generator set controlled from this switchboard insures a finely graduated control of the generator voltage, permitting a smooth increase of voltage on the 2000-volt primary windings of the transformers.

When tests are being conducted, the operator stands on the safety switch in front of the control board. If for any reason he leaves this position, the oil circuit breakers trip and disconnect the 750,000-volt transformers.



Laboratory Control Board

Voltage Measurement

Three sets of gaps with spheres of 1000, 250 and 125 millimeters permit a wide range of accurate voltage measurement.

In addition to the sphere gaps there are three other methods of measurement. Voltmeters calibrated to ratio; voltmeters connected to coils within the transformers and crest voltmeters connected to condenser bushings. Standard needle gaps are also available and the combination of these various instruments permit measurements by all methods.

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(If not, why not? You can get it.)

Delta-Star Electric Co

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2400 BLOCK—FULTON STREET, CHICAGO, ILLINOIS

Electrical World

Published by McGraw-Hill Publishing Company, Inc.
W. H. ONKEN, JR.
Editor

VOLUME 89 — *New York, Saturday, April 2, 1927* — NUMBER 14

Effect of General Business on the Electrical Industry

GENERAL trade statistics indicate that the year 1926 was marked by exceptional industrial achievements, particularly during the early part of the year, and that the country was quite prosperous. This year so far shows that in some important branches production and consumption have declined somewhat, building construction and automobile outputs being instances in point. Yet production and consumption are still immense and stock market quotations are at a substantially higher level than they were twelve months ago. The political outlook, the threatened coal strike, the present plight of the farmers are not disturbing; nonemployment is at a minimum, and trade in general is simply waiting for some automatic revival of demand.

Contrasted with this general situation, the electrical industry stands out in happy relief. On the whole, the output of utilities shows a 10 per cent increase over 1926. New England makes the poorest showing owing to declines in output in Vermont and New Hampshire, and yet the section reports a gain of 6 per cent. It is in the South that greatest gains are being made, the East South Central and West South Central States showing increases of 15 and 22 per cent respectively. The Mountain States are also giving an excellent account of themselves. Thus, unlike most of the other basic businesses, the electrical industry is apparently starting out under about the same conditions as during the first part of 1926, which in turn was 10 per cent larger than 1925. Naturally, this condition in the public utility field is very generally reflected in the manufacturing branch also, so that, taken all in all, there is every reason for satisfaction and none for discouragement.

Aspects of Standardization That Concern Personnel

THERE are two distinct functional activities required in standardization. One is the actual preparation of standards by men who are competent to deal with technical and commercial details, and the other is an executive activity which determines the general policy, fixes the procedure and specifies the groups in industry which should be represented in making each standard.

It is mistaken policy to build a national standards program by giving complete control in standardization to men who are wholly concerned with one of these functions. Much of the present disurbance can be traced to the fact that complete control of industry standards has been given to specialists in standards making. Their training, processes of thought and experience are such as to accent detail, develop individual opinions and give narrow perspectives. They are invaluable as standards makers, and the industry is fortunate in having such talent at its disposal. But the executive function should not be delegated to them.

Few industry executives have thought seriously about standards or concerned themselves with the standards situation. They have delegated authority to specialists and have no clear conception of the great and essential contribution they are equipped to give. It is their job, and not that of a comparatively few specialists in standards making, to formulate a national standards policy and procedure. A meeting of presidents of professional societies, trade associations, large industrial organizations and the Secretary of Commerce should be held to clear the atmosphere and to set up a national policy on standards. This meeting would have its natural result in the appointment of a working committee of executives to make and carry out a plan for a national clearing house on policy and procedure. This might involve a complete remodeling of the present American Engineering Standards Committee in order to man it with industry executives, strengthen its authority, clarify and simplify its procedure, establish adequate financial support for its activities and eliminate from its jurisdiction all elements of standards making.

The executive job in making standards is essential and is well defined. Present conditions result chiefly from the fact that industry executives have neglected this job. The establishment of a national policy and the fixing of a national standards procedure is worth-while work. Its successful accomplishment requires the active participation and continuous functioning of industry executives.

New England Looks Ahead

REASSURING indeed was last week's meeting of the New England Council at Boston to those who have realized the opportunities which have lately arisen for regional co-operation between the power companies and the leaders of public thought in the Northeast. Attacks upon utility companies have been well-nigh unrestrained in political circles during the past winter, and at this writing, indeed, not a few important problems are in the throes of discussion from the Canadian line to Long Island Sound. Maine is trying to solve the power exportation issue without going over to federal control; Massachusetts is sitting up nights preparing rate cases; interconnection is developing along broader lines pretty much all over New England, and the whole industry is concerned with the difficult question of how to finance rural service on a basis which will be fair to every one. Last but not least, the buying and selling of electric and gas properties proceeds at a rate little less than startling to old-timers in the central-station field, and changes in control are in the making which no man can accurately follow through to the end.

The co-operation which the power companies have given the New England Council since its inception less

than two years ago has done immense good. The motives of utility managements in developing their territories for the mutual advantage of the public and of company stockholders have been made clearer to the business interests of the Northeast and, through widespread newspaper reports and comment, to the people at large. The public utility information bureaus have quietly done their part in spreading sound ideas, and so have innumerable utility officers and employees. But the Council meetings have given conspicuous opportunity to utility leaders to enlist in the service of the common welfare, and the results have been surprising only to those unfamiliar with the power of achievement linked with such names as Edgar, Insull, Ferguson, Wyman, Webster, Harriman and others with vision to descry future opportunities to build a greater and more useful industry.

In a masterly address before the Council upon power developments and interconnection, C. L. Edgar revealed an extent of New England progress known to but a few even within the industry itself; Martin Insull briefly touched upon the handicap of Maine's restrictive policy in power exportation, and Governor Fuller of Massachusetts, arch-protagonist of maximum rates, championed state as against federal regulation of interstate transmission and declared himself for electrical home rule. A notable step forward was taken when Mr. Edgar pledged the best efforts of the power interests so far as this could be done without formal action at the moment to two immediate objectives: First, the study of rural service problems on a large scale in co-operation with the agricultural interests of New England, and, second, the enlisting of electric utilities in a movement to bring new industries into the Northeast. It was announced that the plan for voluntary joint commission regulation of power contracts involving interstate energy transmission is making excellent headway and that the work of the power companies' representatives in this program may now be considered complete.

Engineers have often been accused of neglecting public affairs, but no such charge can today be laid at the door of utility leaders in New England. To the wise counsel of the power industry men high in the business world of the Northeast are listening as never before, and there can be no doubt that as a direct result of this co-operation public opinion is being aided to reach sound solutions of current vital problems interwoven with electrical service.

Combining Utilitarian and Artistic Appeal in Fixture Selling

UTILITARIAN and artistic aspects of fixtures and of lighting are usually much too far apart in the minds of designers, salesmen and purchasers. Owing to this separation, one of the two almost entirely dominates the mental approach to the subject of residential fixtures, to the exclusion of the other. It should be obvious that residential fixtures can be sold most readily on the basis of performing both these functions in all their aspects. Why ignore any portion of the selling argument? Those who take cognizance of only one of these characteristics are doing just that.

Of those who permit artistic value to monopolize their attention it may be asked: Why should householders become enthusiastic over purchasing ornaments for the ceiling and walls when there are more satisfactory places for adornment and more appealing ornaments than fixtures? To those who see only the utilitarian value the question may be put: Why should householders become enthusiastic over lighting when confronted with nondescript or inartistic fixtures? The primary purpose of lighting fixtures should be to supply adequate and proper lighting, so that the eyes shall be aided and protected, so that users shall be more comfortable and so that interiors shall be inviting. Lamps which do not achieve these results lose artistic value when lighted, regardless of the esthetic value of the fixture. After these results have been achieved in the design by the use of proper lamps, shades and diffusing media the artistic features can be taken care of. There is adequate proof that good lighting and artistic effect are wholly compatible.

Certainly any emphasis of one of these aspects—utilitarian or artistic—at the expense of the other applies the brakes to progress in residential lighting. It is common sense to combine the two in design and in selling, for there is that much more appeal in doing so.

Plain Talk Among the Merchants

THE recent meeting of the hardware, furniture and electrical dealers with the trade relations committee of the N.E.L.A. Commercial Section has done a good service to the electrical industry. It has offered gratifying evidence that the central-station sales managers are sincerely anxious to conduct their merchandising operations in friendly harmony with other merchants of the communities they serve. It was fair warning that the "trade be damned" spirit will no longer be countenanced by the commercial leaders of the utilities, and it should lead to some very careful thinking in the cities where there has been dissension between the dealers and the power companies because of merchandising policies. It was probably the first formal recognition of the fact that the central-station company has a direct responsibility to other local merchants once it enters the marketplace.

There was much frank talk. The hardware men said, in so many words, "Gentlemen, we have not liked you because we have looked on you as price cutters." And they proceeded to make clear that price cutting does not just mean selling below the list. Price cutting may also take the form of installment sales of appliances too small to justify time payments—or selling on "down" payments that are too low, or on too long terms, or the giving of extravagant premiums. The complaint is that the power companies have been too prone to all these practices. Price cutting means destroying values in the market and compelling competitors to sell at a loss or close the line or go out of business. And this is obviously not good economics. It is not in the public interest, because the public desires to pay a fair price for good value.

It was apparent that central-station men had not been looking on these tricks of selling in just this light. The dealers, on the other hand, have probably undervalued the extent to which they themselves have benefited by the educational work, the pioneering that the utilities have done to build the market that all are sharing. And this point was registered also.

There is a disposition on the part of some power men

to point to conspicuous cases of price cutting by hardware and department stores—it was too bad that no department-store men were also present at the meeting—to justify their own disregard of their brother merchants in the retail appliance trade. This is easy to do, for many examples can be found. But that is beside the point. The fact that the central stations are public utilities in a favored position makes it doubly important that they themselves be without fault. Moreover, price cutting leads inevitably to traffic in cheaper appliances, of poor quality and unsafe. Undoubtedly, some dealers do cut prices. Many do not. But the power company must be the leader in good merchandising, working to elevate the ethics of the local trade. It is the prosperous and enthusiastic dealer who sells the most appliances into the home—and that, after all, is what the central station wants to see.

Continuous Service Transmission

THE art of high-voltage transmission has been developed to a degree which makes it possible to design a line for giving virtually continous service. The great stumbling block to 100 per cent service is found in direct strokes of lightning, but these are very infrequent and can be handled in a way to avoid serious service interruptions. Induced lightning voltages cause lines to flash over or break down the insulation of terminal apparatus, and knowledge exists whereby immunity from this cause of service interruption can be had. Whether this is done is a matter of cost and not of technique.

Present high-voltage lines have not been designed to be immune from induced lightning voltages. On the contrary, a flashover value has been fixed for lines whereby lightning voltages will cause flashovers without injury to conductors or insulators and will give only short-time interruptions. Granted service interruptions on the line, engineers have been concerned with the protection of terminal apparatus, which now has an isulation only slightly higher than that of the line and has no adequate protection against high lightning voltages.

Service standards are improving daily, and line designers would do well to consider making at least the lines of highest voltage immune from flashovers, thus insuring better service. For example, on 220-kv. lines the addition of another insulator or two and of a ground wire or two would prevent flashovers for voltages less than about 4,000,000—a value in excess of the usual lightning voltages. The cost of raising the insulation value of such a line from, say, 1,750,000 volts to 4,000,000 volts may be a small item when measured in terms of the gains from a nearer approach to absolute continuity of service. Indirect savings will accrue also from the elimination of duplicate circuits, sectionalizing schemes and duplications of terminal apparatus.

The cost of insulating terminal apparatus to a degree which will prevent damage from lightning voltages is prohibitive, and it is necessary to turn to other methods. The problem is to keep the high voltages from the apparatus by choking down the incoming waves, deflecting them or absorbing them from the line. These voltages are highly damped and are of steep wave front, so that only a distance of a mile or two from the terminal station need be considered in a protective scheme. Several methods for protecting terminal apparatus from these high voltages suggest themselves, and there is no doubt this aspect of the problem can be solved. Thus it is now possible, and often economical, to design a transmission system which will be free from exposure hazards of a character to interrupt service.

Why Should Not New Street-Lighting Contracts Be Made Profitable?

STREET-LIGHTING contracts have been made political targets from the early days of the industry. For this reason it has often been difficult to renew these agreements on a sound economic basis, and the subject is still a "touchy" one with many utility managers. A vast number of old contracts for this class of service are operative today, and in many executive offices the necessity for renewal comes up so frequently that the ever-recurring negotiations are a constant thorn in the managerial flesh. Only less burdensome is the situation as it affects engineering departments. The matter is important and deserves businesslike handling in the hope of putting this service into black figures in every municipality supplied from power-company lines.

One of the "hang-overs" from the past is the political idea that prices for street-lighting service must compare more or less favorably with other communities. A far better way to meet the situation would seem to be to analyze the costs in every case and base the contract upon these, allowing for a fair return upon the investment after all operating expenses and overheads are met. Not a few companies believe they are making money out of street-lighting sales when they are actually "in the red," and in connection with the installation of better and higher-powered lamps which usually accompanies renewals of such agreements, price readjustments are decidedly in order. In some communities the utility rate structure includes a standard street-lighting schedule of prices which can be applied to any city or town on the system of the power company, but where this convenience exists it is none the less wise to check up the costs from time to time to make sure that the service pays.

The desire of town and city governments to negotiate renewals without regard to the expiration dates of similar contracts in neighboring communities is often a real handicap to a comprehensive plan of development. It is possible that much will be achieved by co-ordinating these negotiations, synchronizing the renewal of contracts, and planning betterment and extension work for larger areas through joint conferences of municipal authorities with the utility representatives. The spread of electric service throughout districts in which city and town lines are merely of political importance gives point to the suggestion that group treatment would save time and money for all concerned. This method of reaching agreement would probably not appeal to the politicians of the separate cities and towns, but it certainly deserves consideration. The time is coming when a manager who recommends an unprofitable street-lighting contract renewal in the face of accurate analyses showing what are fair prices for the new service will have to do some pretty thorough explaining to his superiors, and by the same token many city and town "fathers" will do well to handle these negotiations on their merits and not on political bases.

"Telling the Farmer" with Practical Examples

DISTRIBUTED farm demonstrations of electrical equipment spread the gospel of the advantages of extended uses of power harnessed to perform every-day tasks of the rural communities. Utility companies are bringing themselves direct benefits as well as measurably furthering the progress of the state rural electrification committees' work by well-organized, personally sponsored experimental efforts similar to those described elsewhere in this issue.

Substations for Residential Districts

Necessity for Locating Substations in High-Class Residence Districts Leads to Development of Bungalow-Type Substation of Pleasing Spanish Architecture

By H. L. Doolittle

Chief Designing Engineer Southern California Edison Company, Los Angeles, Cal.

NOT many years ago almost any type of building that would keep out the elements was considered good enough for a substation, regardless of its location. The corrugated-iron building or its somewhat less objectionable successor has been all too common up to within a few years ago. They served the purpose of keeping rain off the equipment, but the less said about their architectural and esthetic shortcomings the better.

The very rapid growth of southern California, involving countless large thickly settled subdivisions, has made it imperative to construct distribution substations in the midst of residential districts. As a result there has been a further natural evolution in the design of substation buildings by the Southern California Edison Company, culminating in a substation of bungalow type of Spanish architecture. It was felt that if the building were in keeping with its surroundings from the standpoint of appearance, if it were noiseless and had every evidence of being a residence, no objections could be raised. Moreover, such a building could be located to give the best service electrically.

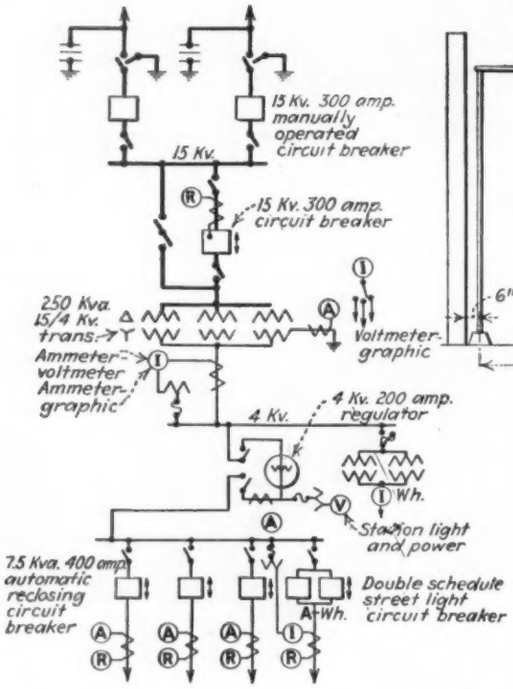
Three of these stations have been built and have brought forth nothing but favorable comment. The company has received letters from real estate agents and residents of the neighborhood saying that they consider the new substations an asset to the community. It is of interest to note that this type of substation costs not over 25 per cent more than the earlier purely utilitarian station. Surely this small additional investment will pay large dividends in the form of public good will.

The imitation of residence architecture has been so close that a stranger cannot identify the buildings as substations, and household peddlers are continually ringing the doorbells to beseech the housewife to take of their wares. These substations receive power at 11,000 or 15,000 volts, three phase, 50 cycles, from either one or two overhead or underground lines and distribute at 4,000 volts, four wire, for lighting or power load and street lighting, overhead or underground. In any case all circuits enter and leave through underground, lead-covered, paper-insulated cables.

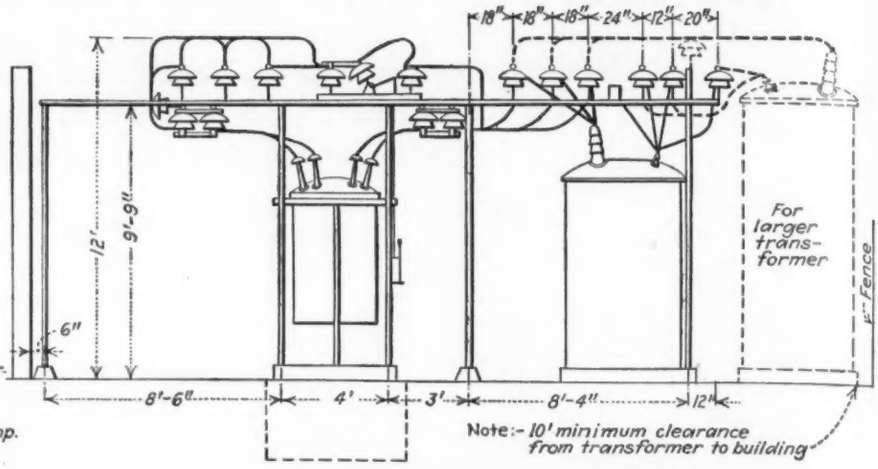
Electrical Equipment Placed Out of Doors Where Possible

The company's practice has been to place all equipment out of doors whenever practical. This gives greater safety from fires and explosions with minimum cost, and in this mild climate does not present difficult maintenance problems. An outdoor installation in a residence district must be concealed in some manner. In this case the high-voltage equipment and transformers are installed in a court behind the building, surrounded with walls which to outward appearance are the walls of a flat-roofed cottage. Even the doors, windows and down spouts are provided to complete the illusion. No part of the equipment inside is higher than the top of the wall, so that the observer outside does not suspect the absence of the roof. For architectural reasons the top of the wall could not be more than 11 ft. high. The high-tension equipment is designed so that exposed parts are not less than the legal height above ground and no other part above 11 ft., which accounts for the somewhat congested appearance of that part of the installation.

The buildings follow the long low lines of California-Spanish architecture. The walls are of metal lath, plastered inside and outside, supported on a wood framework, the lumber having been treated to resist fire. Heavy studding is used to produce the thick walls so necessary to this type of construction. The roof is of

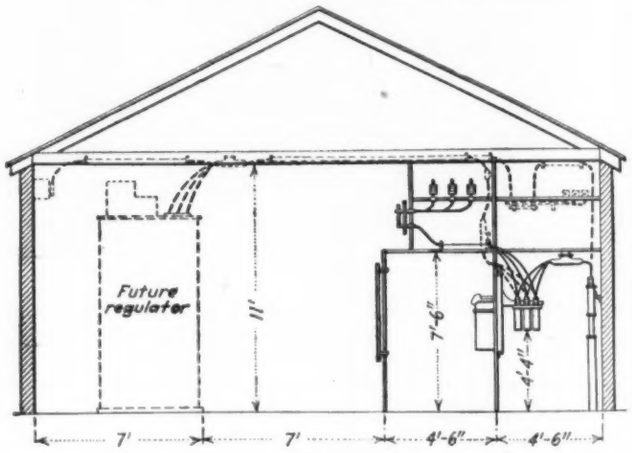


SINGLE LINE WIRING DIAGRAM OF RESIDENTIAL-TYPE SUBSTATION

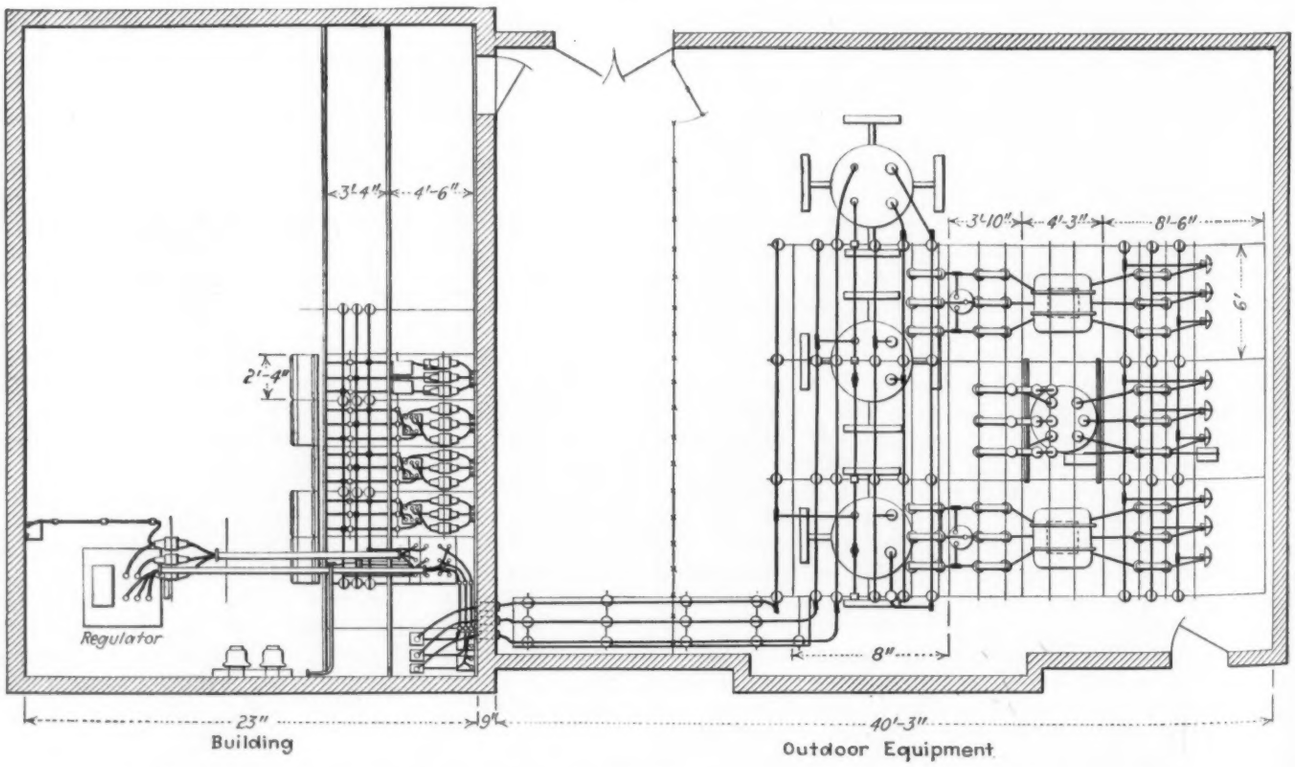


TRANSFORMER SECTION USING OUTDOOR EQUIPMENT

Circuit Arrangements for Residential Type Distribution Substation



ARRANGEMENT OF INTERIOR ELECTRICAL EQUIPMENT



ARRANGEMENT OF BOTH INDOOR AND OUTDOOR ELECTRICAL EQUIPMENT IN RESIDENTIAL-TYPE SUBSTATION

mission tile and the front porch is laid with heavy red tile. The exterior is finished with white stucco, troweled to resemble old adobe walls. Heavy doors and wrought-iron hardware with wrought-iron grilles at doors and windows carry out the Spanish note consistently. The walls around the court are of the same type of construction except that a few steel columns are necessary for stiffness. The court is paved with concrete to keep down the dust. Carefully planned landscaping around the property, with the proper kind of shrubs and flowers, gives the necessary contrast to the plain lines of the building.

Close neighbors to some substations object to the noise made by the apparatus. In these substations the regulator was chosen particularly for its quiet operation, and transformers with an exaggerated hum were rejected. The double-plastered walls have effectively deadened the noise so that even the resident on the adjacent lot has no cause for complaint.

High-Tension Equipment Utilizes Single-Bus Arrangement

The high-tension equipment in the court is laid out with a single-bus arrangement for two lines and one bank of transformers, as shown in the single-line wiring diagram. Three single-phase self-cooled transformers are used, connected delta-star for 11,000 or 15,000 volts to 4,000 volts. The maximum installation contemplated is three 1,000-kva. units. The bus, disconnecting switches and circuit breakers are mounted on a 2-in. galvanized-iron pipe framework with safety screens between circuits. A circuit breaker of 5,000-amp. rupturing capacity may be installed on each line, and also on the transformer circuit. These are manually closed and automatically opened if desired. In the installation illustrated the circuit breakers on the lines are of less interrupting capacity, as they are not opened automatically, being used only to switch out lines. The transformer breaker is of large capacity with induction-type overload relays. A gang-operated air-break switch bypasses the transformer breaker so that it may be removed from service for maintenance work without interrupting the service. In order to remove the tank of this breaker a concrete pit was necessary in which to lower it. The lines are brought in by three-conductor, lead-covered, paper-insulated cables to three-phase potheads. There are no meters on the high-tension side of the station.

The arrangement of the 4-kv. equipment is very flexible. A pipe framework on one side carries the 4-kv. flat bus, the automatic reclosing switches, the disconnecting switches and the switchboard panels. The voltage regulators are lined up opposite the switches with an aisle between. Without a great many alterations the arrangement can be changed from one regulator, regulating the bus as shown in the illustrations, to two buses with one regulator each, or to a regulator per circuit. In the latter case a transfer bus for carrying a circuit in case the regulator or circuit breaker is disabled may be installed.

Stations Designed to Function Unattended

As these stations were designed to be operated without an attendant, automatic reclosing mechanisms are installed on all outgoing 4-kv. feeders. A special arrangement is used for the street-lighting circuit whereby different phases of the primary are opened and closed automatically, on an all night and a midnight schedule, by time clocks with automatic reclosing in case of trouble on any phase. Power for station lighting and for operating regulators and switches is taken from a small bank of transformers connected through fused disconnecting switches to the main 4-kv. bus.

Special attention was given to grounding all equipment and pipe frameworks. A network of No. 4/0 cable connects all apparatus both indoors and outdoors to an electrode in a drilled ground-well of sufficient depth to reach permanent water level. In addition several ground rods are driven at the extremities of the network. The neutral of the 4-kv. winding on the transformers is connected through a current transformer directly to the ground-well terminal block and all grounded wires on the four-wire outgoing circuits are brought to the same terminal block.

The planning and designing of these substations were done in the department of engineering design of the company, and the field work was executed by its construction department.

Back-Pressure Steam Turbines

IN FACTORIES where steam is required for heating, drying, cooking and similar applications attempts are often made for reasons of thermal economy to generate the steam at a high pressure and to employ it initially in a prime mover before utilizing it for one of the auxiliary purposes. Where the amount of superheated steam and the consumption of energy are approximately proportional to each other, the simple back-pressure turbine coupled to a direct-current or three-phase alternating-current generator is now being used.

A large number of such prime movers have been manufactured in Germany. A recent installation of 3,000 kw. capacity has been supplied to a bleaching and dye works in Vienna. It consists of a back-pressure turbine, gearing and a direct-current dynamo.

Another similar installation is that which has been supplied to a Chilean sugar factory. In this instance the steam admission pressure is 165 lb. at 250 deg. C. and the back pressure 30 lb. The amount of steam available for heating and cooking purposes is 16,500 lb. per hour.

Electrical Industry in Britain Hits Stride

ELECTRICITY, which has not made the rapid strides in Great Britain that it has in other countries, has just begun to grip the British manufacturers and the public at large. Vast new electrification plans are to be started this year. London is expected to lead the way in the boom with the construction of two new superpower stations, one at Brentford and the other at Willesden, which will cost $15,000,000 each. Existing stations will be enlarged, those at Hackney and West Ham among others, at a cost of $20,000,000 and there will probably be extensions to the power stations supplying energy to the tubes and railways—an item of something like $10,000,000 additional.

A new superstation to cost $8,750,000 is planned for Coventry, another for Birmingham, others for Oldham and Kearsley, and there is an ambitious ten-million-dollar scheme for Yorkshire. It is reckoned that the 1927 orders for the electrical industry will not stop short of $400,000,000, of which amount about $100,000,000 will be for export trade, the remainder being accounted for by home development.

First Electrically Operated Car Dumper

It Is the First All-Electric Machine to Be Used on the Great Lakes— Some Features of the Electrical Equipment Are Explained— Sequence of Operations of Unit Outlined in Detail

By C. C. Clymer* and C. S. Albright†

DUMPER WITH CAR INVERTED AND UNLOADING INTO SHIP

PRESENT-SCALE coal-dock operation requires the handling of enormous quantities of coal over a single dock. It is expedient therefore that recognition be given to the advantages offered by electric drive—namely, flexibility of control, low stand-by charges, low energy consumption and low maintenance expense, meaning few delays and practically no breakdowns, as well as ability to reach rated tonnage the first season.

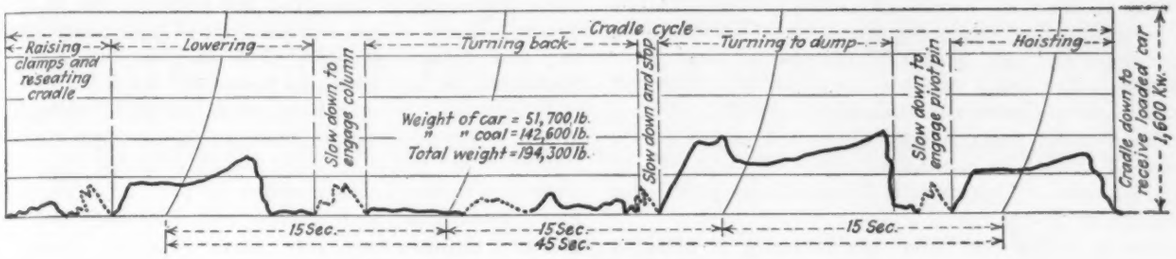
Up-to-date development in the handling of coal finds exemplification in a machine built and erected by the Wellman-Seaver-Morgan Company at the Toledo & Ohio Central Railroad Company's dock at Toledo, Ohio. This is the first all-electric machine to be constructed on the Great Lakes, and the first electrically driven car dumper to be built using Ward-Leonard control on the main drives.

Mechanical Features.—The dumper is designed to handle 120-ton cars having a gross weight when loaded of 330,000 lb. at the rate of 40 cars per hour.

A cycle of operation is as follows: The coal car is started down the hump track under the control of a car rider, who spots the car at the foot of the incline. The cradle operator then starts the mule out of the pit at full speed. As the mule approaches the car, it automatically slows down to the proper speed, engages the car and then automatically accelerates to full speed, bringing the car up the incline. On approaching the cradle the cradle operator takes control of the drive and slows it down to a speed proper for bumping the empty car off the cradle, and as the loaded car moves on to the cradle, the rider spots it and signals the operator to hoist. In the meantime the cradle operator has thrown the mule controller to the lowering position, sending the mule to the pit ready for making the next trip.

The hoisting and lowering movements are started by the cradle operator, but are stopped automatically. When a car has been hoisted and dumped, the operator may throw the hoist controller to the full lowering position and forget it. As the mule has returned to the pit in the meantime, the operator may immediately give his attention to the mule drive, hauling up the next car while the cradle is lowering.

*Industrial Engineering Department, General Electric Company.
†New York Central Railroad.



DEMAND CURVE FOR "CRADLE CYCLE" OF OPERATIONS

Control Features of Main Drive.—In order to gain the maximum flexibility of control and economy in operation Ward-Leonard control is used on the main drives. Important features of this control are:

1. The armature circuit between the hoist motor and the driving generator remains closed at all times except in emergency, so that only field currents of comparatively low magnitude are handled. This condition allows the control apparatus to be simple and of light capacity, resulting in minimum maintenance and repair expense with comparatively few delays.

2. The well-known advantages of high-voltage alternating-current distribution are available, together with the very desirable speed-torque characteristic of the low-voltage direct-current motor.

3. Since it is impossible to secure full generator voltage immediately because of the high inductance of the generator field circuit, the acceleration and retardation becomes very smooth and free from abrupt torque changes in the hoist motor.

4. Retardation practically to standstill is obtained by electrical regenerative braking, which eliminates wear on brakes.

5. The maximum torque of the hoist motor is largely a function of armature current; therefore full rope pull is available even with severe voltage fluctuations of the incoming power.

6. The speed-torque curves obtained on all controller points are relatively flat, regardless of a positive or overhauling load within the rating of the equipment, thus maintaining equal time of trip regardless of size of car, and assuring that one limit switch setting will be satisfactory for all loads.

7. A speed ratio of 7 to 1 from the first to the last controller point is easily obtained.

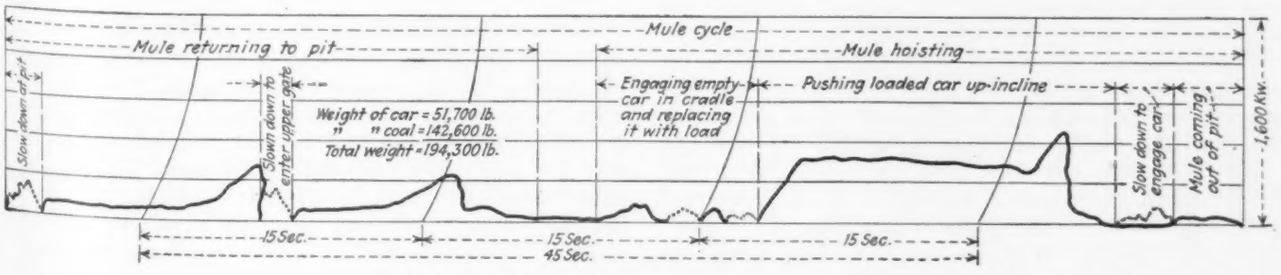
8. Because of the extreme accuracy and flexibility of electric control, only two operators are required; one to handle the mule and cradle drives, and one on the pan to control the pan, chute and trimmer.

In case of power failure, conditions might arise tending to permit the drive to run away. Protection against this is provided by the fact that overspeed of the motor generator applies the solenoid brakes and at the same time applies dynamic braking. The operator may also initiate this action by tripping an emergency switch. The control in general is so interlocked that an abnormal condition in any of the motor-generators or motor circuits proper prevents the operation of the equipment until normal conditions are re-established.

This car dumper has a variable pivot point; hence the problem of providing a suitable slow-down for the cradle to engage the pins and accelerate after leaving the pins could not be met by means of a simple geared limit switch. To accomplish this very desirable method of controlling the motion of the cradle around the pins, without the necessity of placing a track-type limit switch about the structure, a standard automobile differential gear was used. One shaft of the differential is attached to the cradle drums and the other to the screw drive controlling the height of pin. With this differential, changing the point of dumping changes the location of the traveling nut. Hence the point of slow-down and the point of acceleration remain in synchronism with the location of the pin. This condition is also true for the final slow-down and stop in the hoisting motion, since, if the pivot point is lowered, less rope need be taken in on the drum to dump the car. Slow-down and stop for the lowering motion being independent of the positions of the pin, these are controlled by means of track-type limit switches mounted on the structure proper.

DETAILS OF MOTOR-DRIVEN EQUIPMENT

Mechanical Features.—The mule is driven by two 450-hp., 675-r.p.m., 230-volt, shunt-wound motors connected permanently in series electrically and geared to the same drum through a single reduction herringbone gear, one motor on each side of the gear. The cradle is also driven by two 450-hp., 675-r.p.m., 230-volt motors, duplicates of those used on the mule, connected permanently in series electrically and geared through a double-reduction gear train. The first reduction is of the herringbone type and the second of the spur type. One motor is located on each side of the gear. The motors on both drives are equipped with solenoid brakes mounted integral with the motor on the commutator end. To meet emergencies, each drive is equipped with mechanical hand-operated brakes, these brakes being on the couplings on the mule drive and on the jack shaft on the cradle drive. Under normal operating conditions the solenoid brakes are held off by means of the control until the drive is practically at standstill. All


Mule cycle
Mule returning to pit
Mule hoisting
Slow down at pit
Slown down to enter upper gate
Weight of car = 51,700 lb.
" " coal = 142,600 lb.
Total weight = 194,300 lb.
Engaging empty car in cradle and replacing it with load
Pushing loaded car up-incline
Slow down to engage cradle
Mule coming out of pit
1,600 K.W.
15 Sec.
15 Sec.
15 Sec.
45 Sec.

DEMAND CURVE FOR "MULE CYCLE" OF OPERATIONS

retarding is done by means of regenerative braking, except in cases of emergency; when the solenoid brake sets immediately, the circuit is opened between generator and motor and a resistor is connected across the motor armature circuit for dynamic braking.

As the dumper must handle all cars brought to it, obviously it cannot be counterweighted for both 40-ton and 120-ton cars. Therefore it is counterweighted for the average or 70-ton car.

Auxiliaries.—The pan hoist is driven by a 295-hp., 380-r.p.m., 230-volt, open-type, series motor. The control is of the full magnetic type providing straight series control for hoisting, with dynamic braking lowering. Two solenoid brakes are used on this drive, one on the motor shaft and a special solenoid-operated band brake on the jack shaft. The latter was added as a precautionary measure to protect the operator, inasmuch as the pan operates completely out of balance and the operator is located in the chute house at the outermost point of the pan.

The screw machine is driven by a 105-hp., 450-r.p.m., open-series motor, operating as a straight-series motor hoisting, and with shunted armature lowering. A shunted armature connection on the lowering side is necessary as there is a tendency for this screw drive to overhaul. The chute machine is driven by two 45-hp., 500-r.p.m., 230-volt, inclosed series motors, using drum controllers, providing straight-series control hoisting and dynamic braking lowering. The trimmer located on the lower end of the chute is driven by a 5-hp., 850-r.p.m., totally inclosed series motor, using straight-series control.

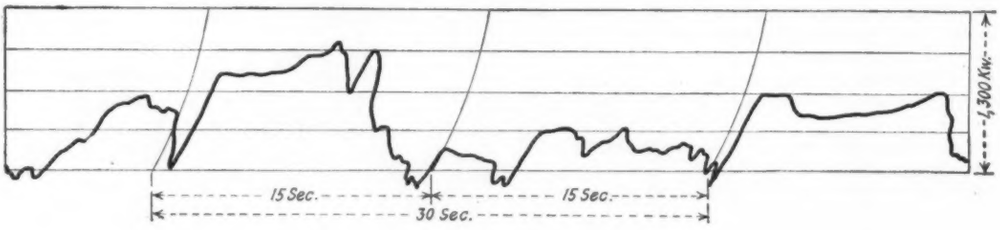
The mule track gates are driven by a 12-hp., 725-r.p.m., 230-volt, series motor, using a series connection hoisting and lowering.

The gate control is of the full magnetic type, fully automatic in normal operation. All gate operations are initiated by the mule limit switch, and under normal operating conditions the operator does not need to give any of his time to their operation.

Interlocking.—One of the main points of superiority in the use of electric drive on a machine of this character over steam operation is the ease with which the installation may be interlocked and automatically controlled to prevent accidents and to speed up operation, and at the same time reduce the nervous strain on the operator. All motions are fully interlocked to insure the correct sequence of operation. The mule and the gates are interlocked in such a manner as to prevent the operation of the mule unless the gates are in the proper position. The mule is also interlocked with the cradle in order to prevent the mule from driving a car on the cradle unless the cradle is properly seated. Slow-down and acceleration of the cradle around the pin is automatic and independent of the operator. This speeds up operation and at the same time saves the equipment, since the speed of engaging the rotating pin is always correct. On a steam-driven dumper operations around the pin depend on the skill and dexterity of the operator, the best of whom have "off" days.

Substation.—Power is received at 6,600 volts, three phase, 60 cycles, and is distributed to three duplicate synchronous motor panels, which control three synchronous motors. Each motor is part of a three-unit motor-generator and drives two 375-kw., 900-r.p.m. 250-volt, shunt-wound generators. One set is arranged to furnish power at 250 volts for the auxiliaries and for exciting the Ward-Leonard control, and also power at 500 volts for some rheostatically controlled ore unloaders operating on the same dock. The other sets furnish power for the mule and cradle drive, one generator from each set being on the mule and one from each set on the cradle. Operation of the dumper with only one of the Ward-Leonard sets running is permitted. Provision is also made for furnishing power for the auxiliaries from one of the Ward-Leonard generators. Thus the dumper may be operated at reduced capacity with any one of the motor-generators out of commission. This arrangement permits the loading of a boat regardless of the failure of any piece of apparatus in the substation.

Operating Data.—All rough construction work was completed about March 15, 1926, and the dumper was put into regular commercial service about April 15. It has been working on a regular 24-hour shift since that time, having dumped up to the first of November approximately 3,700,000 tons of coal, with an average power consumption of 0.24 kw.-hr. per ton handled. Should operations continue on the present scale, this machine will handle more coal its first year than has been handled by any steam dumper operating on the Great Lakes in any year.



TYPICAL CURVE OF POWER INPUT TO DUMPER

It is particularly to be noted that the machine has been able to handle this amount of coal in this time by dumping cars ranging from 40 to 100 tons capacity, but only averaging around 54 tons per car, no 120-ton cars having been received up to the present time. The dumper was constructed, however, to meet future requirements of the railroad.

Generating Steam from Hydro Power

THE Hydro-Electric System of the city of Winnipeg, Manitoba, has a steam-heating utility specially designed for steam production from off-peak electric power, to meet the competitive cost of producing steam with coal fuel. It is charged at the rate of 0.1 cent per kilowatt-hour. During 1926 64,000,000 kw.-hr. was used for this purpose, bringing the city an additional revenue of $64,000 for energy which would otherwise not have been used.

Functioning of a Power-Sales Department

Study of Load Conditions of Each Power Customer Affords Data that Have Great Value in Negotiations with Prospective Customers—Energy Requirements of Any Plant Reduced to Terms of Production

By R. A. Graves

Assistant to Vice-President in Charge of New Business, Kansas City Power & Light Company

TO ACQUIRE new business for the company and to develop the business already on its lines are the functions of the power-sales department in an electrical utility. The accomplishment of this object requires a department personnel composed of men who are not only well-trained industrial engineers but who can deal with the prospect or customer with all the tact of a good salesman. The men must be able, first, to sell themselves, then the company and the service it renders. To do this the power salesman must know the customer's business almost as well as he knows the utility business. It has therefore been found that to secure the best results the power salesmen should be assigned to certain classes of industries, related as follows:

Flour mills and grain elevators.
Rock crushers, cement plants and sand plants.
Steel mills and metal products.
Woodworking plants, furniture making and printing.
Ice, refrigeration and food and dairy products.
Office buildings, hotels and apartments, stores, etc.

In this way each man will become well versed in the problems of his particular class of industry and well known by the people with whom he deals. Also he is not double tracking on the territory of other sales engineers.

TABLE I—ICE AND REFRIGERATION

Magazine	Date	Page
Power	January 27, 1925	143
ELECTRICAL WORLD	August 8, 1925	264
Power	April 27, 1926	635
Ice and Refrigeration	October, 1926	215
Power	December 14, 1926	913

By keeping in constant touch with the local chamber of commerce and with architects and developers of industrial districts, any prospective industry contemplating a move to the locality is given personal attention and information regarding the power requirements and costs, which in some cases are determining factors. In several instances it has been found advisable to send the power salesman to the home office of an industry, either prospect or customer, to work with the engineers in laying out a proposed installation, thereby keeping the idea of "purchased power" uppermost during the preliminary and final stages of the development.

Subscriptions are carried for all trade journals that have to do with the affairs of industries served by the company. When one of these magazines comes to the department, it is referred to the man who takes care of its class of industry. He goes over the articles and, finding one or more worth saving, posts the name of the magazine, date of issue and page numbers in a reference index, which is kept on file with all magazines. This method of keeping data was found to be much more satisfactory than clipping the articles out, as they are very easily lost. A sample of a page from the reference index is given in Table I.

In this way late information on what is being done in a particular industry is always available. Whenever an article appears that is of great interest to the department as a whole, this article is typed and enough copies are made with a "ditto" machine to place one in the hands of every member of the department. All publications put out by the different national societies for the development of their particular branches of industry are kept on file along with the catalogs and bulletins of manufacturing companies giving the operating characteristics and guarantees of their products. Whenever any tests are made on an isolated plant or installation on the system, a complete report such as is given to the prospect or customer is placed on file for reference. This specific education of salesmen is augmented by regular departmental meetings, where information on experiences with prospects or customers are exchanged and general discussions of engineering sales methods are indulged in.

In addition to the above-mentioned methods of keeping the salesman informed of the actual operating characteristics of a particular industry, a card file is kept of each customer's electrical operating conditions.

For each power customer with a demand of 10 kw. or more such a card is kept, and each month the data are filled in and filed so that information on past experience is always at hand. Each customer's demand is taken by means of a G-4 demand meter, which registers the average half-hour demand. With the aid of this chart it is often found that the salesman can work with the customer in avoiding exceptionally high and isolated peaks in his daily load curve.

TABLE II—FORM IN WHICH CUSTOMER'S ELECTRICAL OPERATING CONDITIONS ARE KEPT IN FILE

Customer's name..... Address.....
Contract No. B-1487 Date signed, July 17, 1922. Term of years, 20.
Meter No. 31-EK-196 Class of service, 13,200 volt primary, 1 power factor.
Year, 1925 Minimum demand, 350 kw.

	Demand					
	Off Peak	On Peak	Kilowatt-Hours	Net Bill	Net Rate, Cents	Load Factor, Per Cent
January	450	300	162,130	$2,055.17	1.26	50.00
February	450	300	149,060	1,957.15	1.31	46.00
March	450	300	167,515	2,095.56	1.25	56.50
April	527	300	186,140	2,335.94	1.25	49.00
May	527	300	197,500	2,421.05	1.23	52.10
June	527	300	205,500	2,482.19	1.21	54.3
July	527	300	239,210	2,732.94	1.14	63.0
August	527	300	253,000	2,839.34	1.12	66.7
September	527	300	210,100	2,514.94	1.19	55.4
October	527	300	190,200	2,366.11	1.24	50.00
November	712	400	250,000	3,071.63	1.23	48.1
December	712	400	225,000	2,883.13	1.28	43.3
Total	....	....	2,435,355	$29,755.15	....	....
Average	563	333	203,000	$2,479.59	1.22	52.4

To show the customer or prospect just what net rate per kilowatt-hour would be earned by different methods of operating a curve is plotted, in cents per kilowatt-hour, against load factor. With the aid of this curve it can be calculated whether the saving made by operating over a longer period of time, with a lower demand, would offset the additional labor cost of another shift. To illustrate, take a demand of 300 kw. for eight hours to use 2,400 kw.-hr. per day. Would a saving be made to use the 2,400 kw.-hr. in two eight-hour shifts with a demand of 150 to 175 kw.? The net rates can be taken from the curve to calculate the power costs, and the customer or prospect already knows what the labor cost of one shift is. In a number of cases it has been found economical to operate two shifts rather than one. In this way the salesman becomes well versed in the actual operation of a particular industry.

It is this close co-operation between the company and the customer or prospect that tends to create confidence in the company and drive home the faith that it always stands ready to serve not only with electric energy but with real engineering service to further the economical use of purchased power.

At the end of each year the customer's "load card" is taken and classified, as was mentioned in a previous paragraph, and a general summary of all industries in their several classes is made. It is always necessary when compiling a set of figures, such as is shown in the accompanying table, to be able to get from the customer certain facts and figures that show the capacity of his plant or the output for the year in a unit that is used for his particular class.

The use of these figures in talking to the prospect is shown by the following example. Dividing the barrels capacity of 19,400 by the number of kilowatts, 6,714, gives a figure of 0.34, which is the relation between barrels capacity and kilowatt demand. This may be used for estimating purposes in arriving at a prospect's demand on an average half-hour basis by multiplying barrels capacity by 0.34 to estimate kilowatt demand. This figure allows for a certain amount of elevator capacity to be operated in conjunction with the mill.

TABLE III—RECORD OF EACH CUSTOMER'S PRODUCTION IS KEPT WITH PERTINENT ELECTRICAL FACTORS

Customer Number	Bbl. Capacity	Elevator Capacity	Kilowatt Demand	Kilowatt Hours	Net Rate, Cents	Yearly Load Factor, Per Cent
1	6,000	2,500,000	2,016	11,886,000	1.08	68.2
2	3,000	1,000,000	898	5,159,000	1.12	68.2
3	2,500	2,250,000	1,309	6,779,000	1.12	64.3
4	1,700	400,000	587	2,741,880	1.15	56.9
5	1,500	225,000	403	2,578,560	1.34	72.9
6	1,400	250,000	380	1,210,784	1.42	38.7
7	1,600	300,000	604	1,109,800	2.08	22.8
8	1,200	350,000	345	1,652,100	1.27	55.1
9	500	200,000	172	233,100	1.77	28.4
Total..	19,400	7,475,000	6,714	33,350,224	....	....
Average	2,160	830	746	3,700,000	1.37*	52.8

*The average rate of 1.37 cents per kilowatt-hour does not take into account the fuel credit, which is an average of 0.083 cent per kilowatt-hour.

In the cases of grain elevators there are two classes, straight storage houses and grain-conditioning elevators. It is always easy to determine the connected load of any grain elevator, and whether it be a storage or conditioning elevator, the total connected load in horsepower multiplied by 0.26 will give a very close approximation of average half-hour kilowatt demand, and the yearly load factor is approximately 15 per cent average.

For a small town, served from a "high" line, with a population of from 200 to 1,000, it has been found that the number of customers is approximately 20 per cent of the population, and if there are no large industries, the yearly load factor is from 18 to 21 per cent on a demand of 400 watts per customer. In the same way in Kansas City the year 1925 gave a total of 358 customers, which could be given definite places in thirteen different classes, a summary of which is presented.

TABLE IV—CLASSIFICATION OF 358 INDUSTRIAL CUSTOMERS IN KANSAS CITY

Classification	Kilowatt Demand	Kilowatt-Hours	Load Factor, Per Cent
Flour mills and grain elevators	10,440	39,217,531	42.9
Iron and steel	7,491	26,051,539	39.8
Public utilities	4,561	18,611,803	46.6
Sand, cement, rock	4,706	20,132,441	48.7
Ice and refrigeration	3,324	15,917,649	54.6
Hotels and buildings	3,929	14,296,919	41.5
Stores and theaters	3,658	9,566,517	30.7
Woodworking	1,375	2,662,095	23.1
Food products	2,481	5,909,107	27.2
Dairy products	1,157	3,768,499	37.2
Gas and air	1,230	4,674,662	43.4
Printing	699	2,088,426	33.9
Battery manufacturing and charging	616	2,037,566	37.7

The use of these tabulations has rendered it unnecessary for the meter department to make long and expensive tests to determine the size of meter to install for a permanent installation. When the salesman writes the connection order for the meter, the connected load as well as the kilowatt demand is indicated. Most of the power customers whose demand is 75 kw. or more now own their own transformer stations and buy power on high-voltage contract. Their transformer stations are designed by the company and are installed on a time and material basis for the customer; or the customer is furnished approved prints of the station and he lets an electrical contractor build it under the supervision of the engineering department of the company.

The schooling of a power salesman is never finished, as he must keep in touch with all of the latest developments from both a manufacturing and an operating standpoint. The one essential when selling power for industrial purposes in competition with oil engines, steam engines and turbines, gas engines, or whatever it is, is that he must "know as much about his competitors as they know about themselves."

Latest Figures on Costs and Ratings of Ontario Hydro System

COSTS of the power plants now operated by the Ontario Hydro-Electric Power Commission were given in a statement tabled recently in the Provincial Legislature. They are as follows:

Queenston—Chippawa development, $76,302,481; Ontario Power development, $22,026,481; Electrical Power development, $12,017,814; Big Chute development, $664,663; Eugenia Falls development, $1,139,600; Wasdell's Falls development, $146,390; Muskoka development, $737,743; Nipigon development, $10,410,955; Rideau development, $839,006; Central Ontario development, $7,774,359; Nipissing development, $699,462.

The horsepower development in 1926 was as follows, the figures showing peak capacity horsepower:

Queenston — Chippawa development, 550,000; Ontario Power development, 180,000; Electrical Power development, 145,000; Big Chute development, 5,800; Eugenia Falls development, 7,400; Wasdell's Falls development, 1,000; Muskoka development (two plants), 6,750; Nipigon development, 75,000; Rideau development (two plants), 3,000; Central Ontario development (nine plants), 47,028; Nipissing development (two plants), 3,600.

Developing Hydro Plant Addition to Conserve Stream Flow

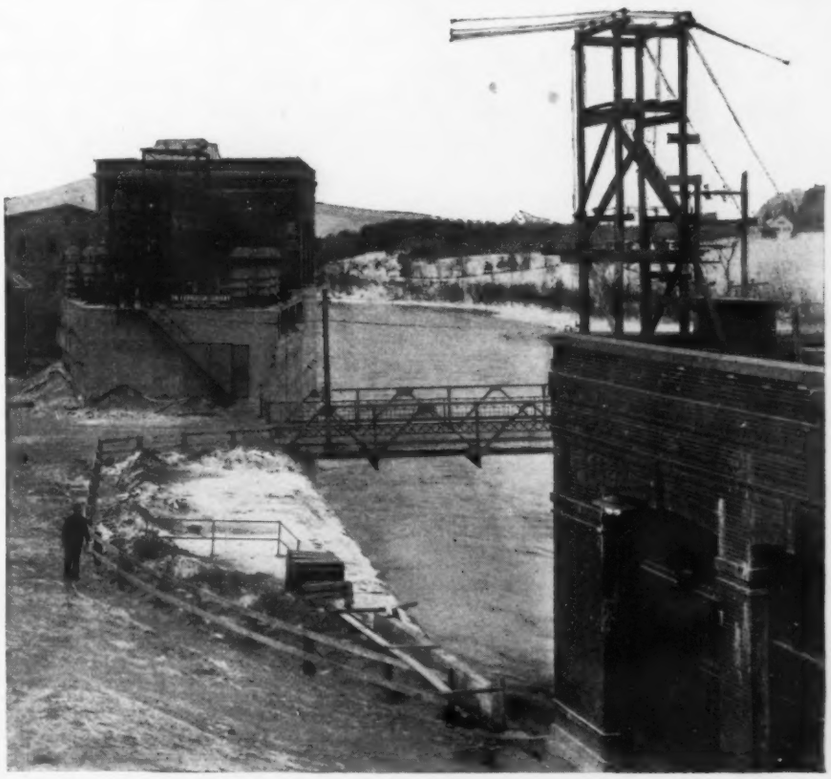
West Buxton Unit Facilitates Efficient Co-ordinated Operation of Existing Stations—Interesting Engineering Problems Created by Space Limitations—Switching Station Placed on Surge Chamber

By George E. Haggas

Chief Engineer Cumberland County Power & Light Company, Portland, Me.

DURING the past season a unique water-power development has been constructed by the Cumberland County Power & Light Company on the Saco River at West Buxton, Me., for the purpose of utilizing stream flow previously wasted on account of the larger capacity of the plants above. This new development is an addition to the company's hydro plant at this location. No changes have been made in the old plant, the new unit being housed in a new power station 270 ft. downstream from the old station. The dam for the old plant also serves the new plant.

The Bonny Eagle hydro station of the company is about two miles upstream from the West Buxton plant. It has a discharge capacity of 4,725 cu.ft. per second and a storage pond of 101,000,000 cu.ft. The old station at West Buxton has a discharge capacity of but 2,925 cu.ft. per second and a storage pond of only 6,250,000 cu.ft.—that is, about five-eighths of the discharge and one-sixteenth of the storage of Bonny Eagle. Due to this situation, much water has been wasted at West Buxton because this plant could not use all the water passed at Bonny Eagle and this surplus water from Bonny Eagle could not be stored in the relatively small pond at West Buxton. Moreover, the efficiency of the waterwheels in the old West Buxton plant is considerably less than the wheel efficiencies at Bonny Eagle. This difference in efficiency is more marked in three of the wheels at Bonny Eagle which were installed about six years ago.



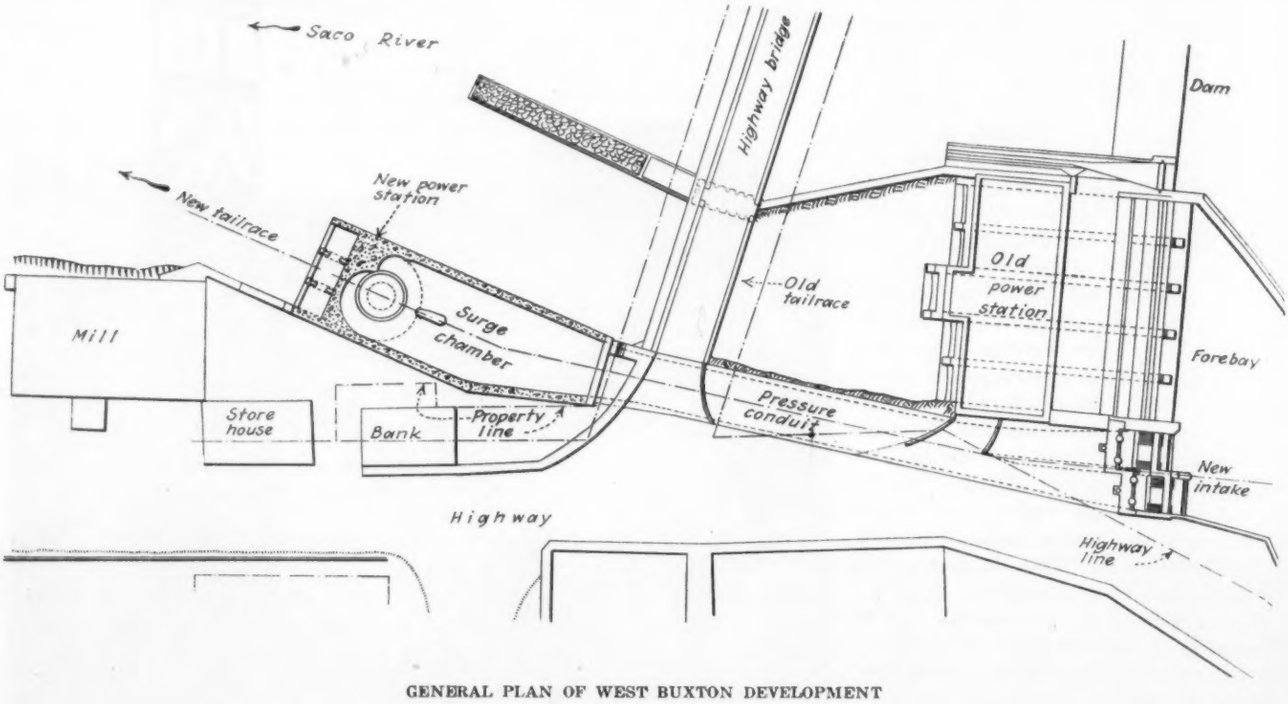
NEW STATION WITH OLDER PLANT IN FOREGROUND

Since there is no additional storage available at West Buxton, it was decided that the most feasible way to remedy these uneconomic conditions was to equalize the discharge capacities of the Bonny Eagle and West Buxton plants by installing an additional unit at West Buxton. Then they could be operated as one, thereby utilizing, in conjunction with the larger storage pond at Bonny Eagle, the flow of the river to the fullest extent.

The problem was how to provide at West Buxton sufficient waterways in the cramped space available to pass 67 per cent, or 2,000 cu.ft. per second, the extra amount of water necessary to bring the discharge capacity up to that of Bonny Eagle. If the old power house were extended to the west so that more machinery could be installed to use this extra water, it would mean a reduction in the spillway capacity of the dam. Since this capacity is low, it was decided that encroachment on this limited spillway would be unwise. It will be observed from some of the accompanying illustrations that there are a number of brick buildings located near the old power house. The main highway passes between some of these buildings and the old power house. As a matter of fact, this old power station is practically at the center of the village of West Buxton. An extension of the old power house to the east would blockade this main highway, and if the right to do this could have been obtained, which is doubtful, it would have been very expensive on account of the land damages involved, to say nothing of the construction costs. Owing to insufficient space, the intake of the old station could not be enlarged to pass the extra amount of water required, and since the tailrace capacity of the old station was utilized to the fullest by the old ma-

chinery and could not be widened without great excavation expense and a new span for a highway bridge 125 ft. downstream from the old station, it was decided it was impractical to increase the waterway passages of the old station.

There was needed 67 per cent, or 2,000 cu.ft. per second, more discharge capacity, but the question was where to obtain the space for it. This was finally worked out by building a new double intake on the east of the old intake and constructing a buried pressure conduit or tunnel below the surface of the main highway and under the crossroad extending over the river to a point below the highway bridge just mentioned. At this point the roof of the tunnel was raised and a surge chamber created directly upstream from the new power station. The tailrace from the new station merges with the old tailrace at a point where sufficient space was available to provide an ample waterway for both plants. All of the new work is of reinforced concrete except the power house superstructure, which is of brick with a structural steel frame. All foundations are carried to rock.



GENERAL PLAN OF WEST BUXTON DEVELOPMENT

The municipal officers, in granting authority for the construction of the new project, specified that no part of the finished structure within the limits of the highways should be above the ground surface.

For this reason the head gates of the new intake are not opposite, the easterly gate being 7.5 ft. upstream from the westerly one. Had these been placed in line, the intake structure would have extended into the highway about 3 ft. The staggered arrangement adopted meets the requirements of the municipal officers and provides the necessary cross-sections for proper intake velocities.

The new intake adjoins the old one on the east and consists of two openings each 15.5x15.25 ft. high, each opening being controlled by one structural steel sliding headgate. Each headgate is equipped with a 20-ton, pedestal type inclosed worm and gear hand-operated hoist. These hoists require far less space than the open spur-gear hoists with pinion and racks on the gate stems. The gate stems of the new headgates are of Tobin bronze and are threaded to engage the gear train in the hoist pedestal. The trash rack bars are 4x$\frac{3}{8}$-in. wrought iron, the upstream part being beveled to $\frac{1}{4}$ in. thick in order to improve flow conditions. The rack bar spacing is 4 in. in the clear. These bars are in sections and are supported on I-beams spanning the intake opening, the bottoms of the bars being placed in a groove formed by a channel and the tops fastened by clips to a reinforced-concrete beam. (The trash racks of the old plant originally were not fastened. Sunken logs knocked some of them apart, with the result that pulp wood got into the wheels and destroyed a number of wicket gates.) Directly upstream from the new trash racks provision has been made for the installation of needles so that the intake can be unwatered if repairs to racks, headgates, etc., are necessary. In the transverse head wall of the intake air vents 20 in. in diameter are formed just downstream from the center of each headgate.

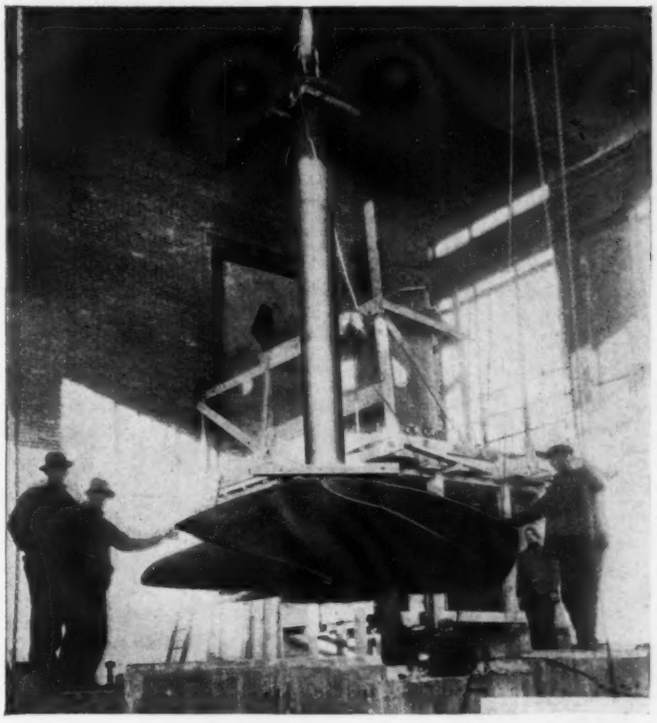
The pressure conduit or tunnel between the intake and surge chamber is 226.5 ft. long and has a minimum cross-section of 20x15 ft. From the intake where the conduit is in two sections each 15.5 ft. wide by 15.25 ft. high the size of each is gradually reduced until at a point 63.75 ft. downstream from the east headgate they merge into one section 22 ft. wide by 15 ft. high. This section is gradually reduced until the minimum section is reached at a point 100.5 ft. from the east headgate. From this point the cross-section is gradually increased to 24.0 ft. wide by 17.5 ft. high, at which point it joins the surge chamber 226.5 ft. from the east headgate. All of the above are inside dimensions. The cross-section of the conduit in the smallest place is sufficient to allow two automobiles to pass abreast. Near the lower end of the conduit the crossroad extending over the river is carried on the conduit roof and the highway bridge trusses are supported on the east wall of the conduit. A reinforced concrete slab was cast on

the roof of the conduit to serve as a wearing surface for this crossroad and a bridge seat was formed to take the bridge trusses.

The surge chamber has a cross-sectional area of about 2,500 sq.ft. It is 36.5 ft. high, 75 ft. long and varies in width from 24 ft. at the conduit to 38.5 ft. at the power house. The west wall of the surge chamber is parallel to the tailrace of the old power house. This wall is provided with a spillway so that when sudden load changes occur the resulting surge can overflow into the old tailrace at a point below the highway bridge. The crest of this spillway is 3 ft. above normal pond level. It is estimated that when full load is suddenly thrown off, the surge will be about 6 ft. above normal level, 3 ft. of which will be carried away by the spillway.

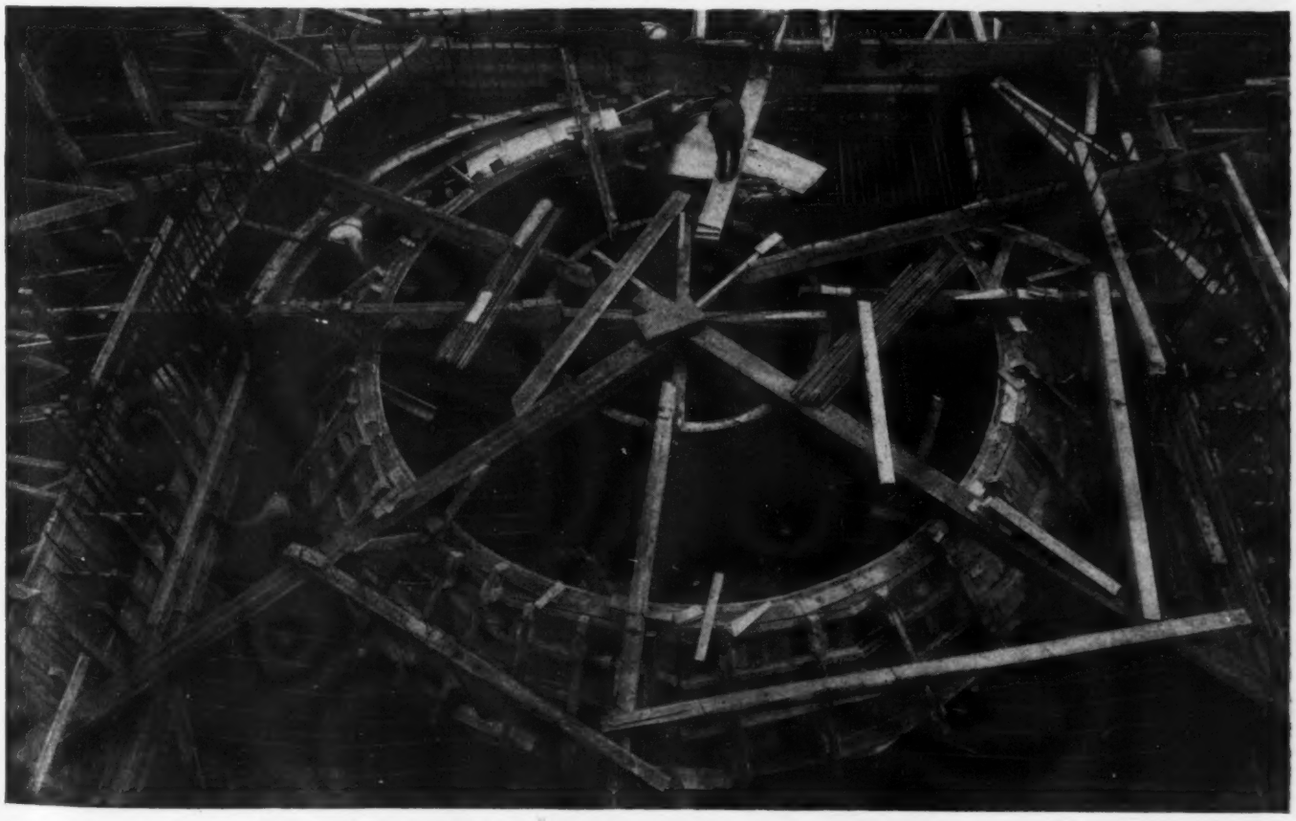
FEATURES OF POWER HOUSE

The power house substructure consists of a reinforced-concrete scroll case in volute form and of rectangular cross-section having a maximum width of 38.5 ft. and maximum height of 17.5 ft. The main and only floor of the station is 42 ft. 10 in. wide by 48 ft. 10 in. long. The generator is mounted on a pedestal 24.5 ft. in diameter and 6 ft. 1½ in. above the floor. Stairways from the main floor lead to the wheel pit and to the exciter platform of the main unit. From this platform a runway extends to a transformer platform in the northeast corner of the station. The transformer platform is at the same level as the deck over the surge chamber, and is provided so that the power house traveling crane can handle the heavy switch gear and transformers comprising a part of an outdoor substation located on the deck of the surge chamber. The base of the switchboard is directly below and set back 3.5 ft. from the edge of the transformer platform so that there is no danger of switchboard instruments or panels being damaged by a swinging crane hook. The roof is a 4-in. reinforced concrete slab covered with tar and gravel. The walls of the power house are of brick and reinforced concrete.



CAST-STEEL PROPELLER-TYPE RUNNER OF 5,400-HP. TURBINE

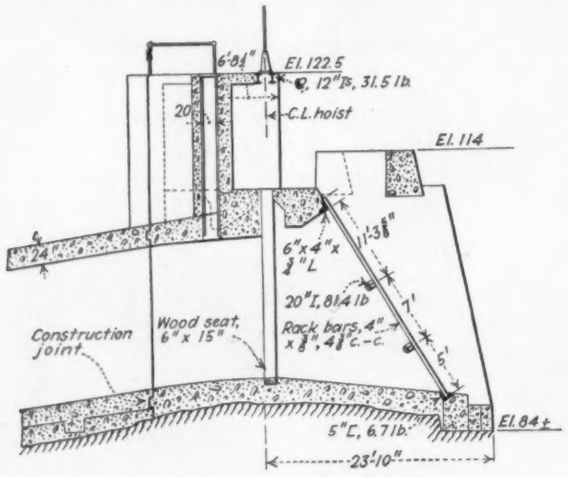
The concrete scroll of the power house substructure, the surge chamber, conduit or tunnel and intake were all



REINFORCEMENT OF SCROLL-CASE FLOOR, DRAFT TUBE IN CENTER

designed to withstand the full hydrostatic head under maximum high water conditions plus an allowance for impact of 25 per cent of this head. In the scroll case floor bending moments were found as high as 157,000,000 inch-pounds, where a beam 7 ft. deep was used. Conservative working stresses were used throughout.

Due to limited space (there being barely enough room for the finished structure, to say nothing about room



DETAILS OF INTAKE FOR NEW PLANT

for construction plant and building operations proper), all concrete was mixed on the opposite side of the river from the new work. Here a stone crusher with bucket elevator, screen, stone and sand bins, concrete mixer and cement house were installed. The mixer discharged into bottom-dump 1-yd. buckets carried on Ford cars, which transported the mixture across the highway bridge to the site of the work, where stiff-leg derricks or a caterpillar-type crane swung the buckets to the forms. An inert material (Celite) was added to the aggregate when mixing and it was found that this material reduced segregation and expedited placing. The length of haul varied from 800 to 1,000 ft. Sand and stone were obtained chiefly from a gravel pit one mile distant from the crusher. All of this run-of-pit material was passed through the crusher and screened. Some crushed stone was obtained from rock excavated from the tunnel site. All of the construction plant was motor operated with the exception of the caterpillar crane.

OVER-ALL FLOOD DISCHARGE CAPACITY INCREASED

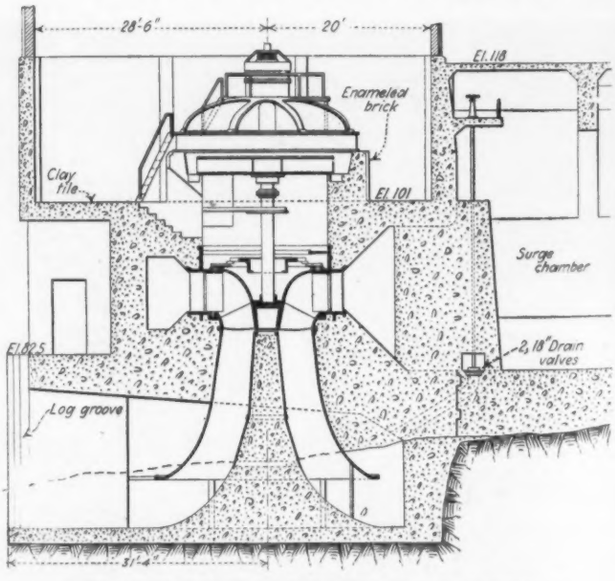
As previously stated, the discharge capacity of the spillway of the main dam, due to its length and limited freeboard without flashboards, was low. This has been improved by providing 3 ft. of additional freeboard, which was obtained by raising old dikes and building new ones with spoil obtained from the new work. Since the spillway of the new surge chamber will be in operation during periods of high water, the flood discharge capacity of the West Buxton plant as a whole has been increased by this additional spillway length as well as by the discharge of the new unit. By reason of these changes the over-all flood discharge capacity of this plant has been increased from 22.6 cu.ft. per second per square mile to 39.5 cu.ft. per second per square mile, the drainage area being 1,550 square miles. The average rainfall (twenty-year average) is 41.87 in.

The waterwheel equipment was furnished by the I. P. Morris department of William Cramp & Sons Ship & Engine Building Company and consists of a vertical six-bladed propeller-type runner 133 in. in diameter with inside gate mechanism and rated 5,400 hp. for 27 ft. head at 120 r.p.m. and a guaranteed efficiency of 89 per cent—expected 91 per cent. The 70,000-ft.-lb. governor is a Pelton actuator oil type and is belt driven from the main shaft. The draft tube is a plate steel Moody spreading type with an inner cone extending from the floor of the wheel pit to the hub of the runner. The runner and gates, of which there are sixteen, each 5 ft. high, are of cast steel, the remainder of castings being cast iron. The main shaft bearing is lined with babbitt and arranged for oil lubrication circulated by a rotary oil pump belt driven from the main shaft. It is stated by the manufacturer that this is the largest capacity propeller-type runner for 27 ft. head that has ever been built in this country.

CAPACITIES OF OLD AND NEW PLANTS COMPARED

The discharge capacity of the new unit at maximum efficiency (full gate) is 1,965 cu.ft. per second, which is about equivalent to the combined discharge at best efficiency of the three modern wheels at the Bonny Eagle plant. The total discharge at West Buxton of the old and new station is 4,890 cu.ft. per second, which compares with 4,725 cu.ft. per second for all the wheels at the Bonny Eagle plant. When four of the old West Buxton units installed in 1907 are renewed it is planned to reduce their present discharge by 265 cu.ft. per second, or 66 cu.ft. per second per unit, thereby relieving by this amount the present restricted flow in the old tailrace and making identical the discharge capacities of Bonny Eagle and West Buxton plants. In this way the main objective of this development will be accomplished.

A flow of 2,000 cu.ft. per second, or 1.29 cu.ft. per second per square mile of drainage area, prevails at West

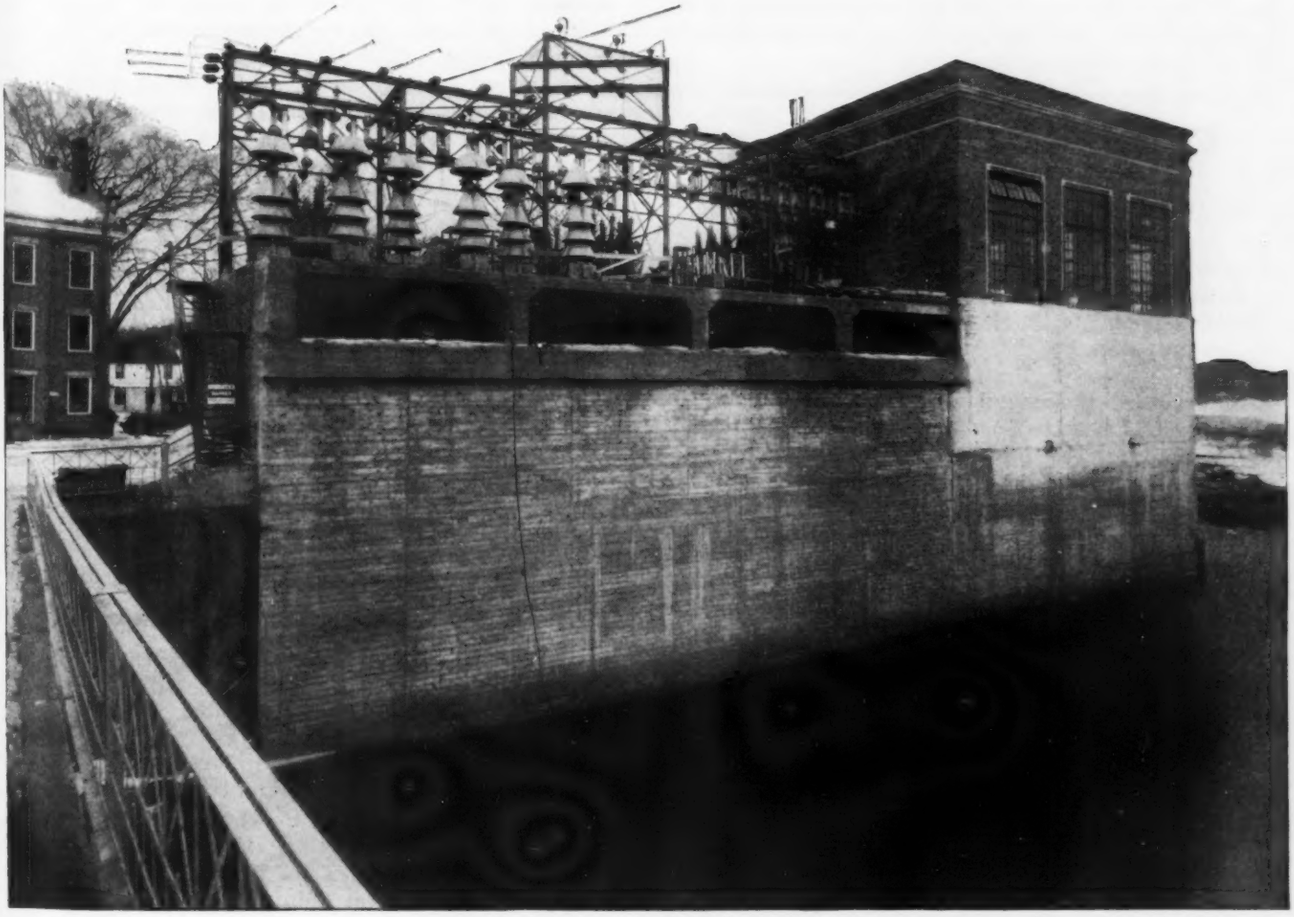


CROSS-SECTION OF WHEEL SETTING AND PORTION OF SURGE CHAMBER

Buxton for 50 per cent of the time. A flow of 4,700 cu.ft. per second, or 3.03 cu.ft. per second per square mile, is available at West Buxton for 22 per cent of the time. From this it is expected that the new unit will be in operation at full load for at least 50 per cent of the time and that both old and new plants will be fully loaded for at least 22 per cent of the time. Owing to the fact that there are five units in the old plant, each

having a discharge capacity at best efficiency of 470 cu.ft. per second, advantageous use can be made of all flows from 470 cu.ft. per second to 4,700 cu.ft. per second. Few plants with similar investment have greater flexibility, which is a primary requisite for plants located on streams that have such a wide range of discharge as the Saco River (200 to 35,000 cu.ft. per second).

The rating of the generator is 5,000 kva., 120 r.p.m., 11,000 volts, 60 pole, three phase, 60 cycles. It is provided with amortisseur windings, 125-volt direct-connected exciter and a spring-type thrust bearing of



POWER HOUSE EXTERIOR, SURGE CHAMBER AND OUTDOOR SWITCHING STATION

325,000 lb. capacity. The flywheel effect (WR^2) is 4,000,000 ft.-lb. squared. The stator frame is welded plate steel. The rotor spider is of turbine iron having a laminated steel rim with dovetailed pole pieces. The lower guide bearing bracket is of structural steel. The support for the upper bearing is cast iron. The thrust bearing is provided with external pipe coils located on the lower guide bearing bracket and in the path of the incoming cooling air for the generator so that when hot oil from the bearing is pumped through these coils the heat is radiated to the surrounding air. This machine is provided with full automatic control equipment, which is so installed that the operator in the old plant will have full control of the new unit. All generating and control equipment was furnished by the General Electric Company.

The outdoor substation on the deck of the surge chamber consists of a 5,000-kva., three-phase transformer with high-tension switch gear for incoming and outgoing transmission lines from other stations and for the new and old generating equipment. All disconnects and buses are mounted on a structural steel frame, which also serves as a dead-end fixture for the transmission lines. The major dead-end load carried by this fixture is from the river spans of some of the transmission lines, these river spans consisting of twelve 2/0 copper wires 380 ft. long. All switch gear and transformers were furnished by the Westinghouse Electric & Manufacturing Company.

The power house 45-ton traveling crane was built by the Northern Engineering Works of Detroit and is of 40-ft. span and 30-ft. lift with an electrically driven hoist. The bridge and trolley travel are hand operated. All movements of the crane are controlled from the main floor level.

The job was begun on May 19, 1926, and the unit was started on Jan. 26, 1927. The main construction quantities are 8,211 cu.yd. of earth and 4,734 cu.yd. of rock excavation, 7,387 cu.yd. of concrete requiring 75,000 sq.ft. of forms, 450 tons of reinforcing steel, 72 tons of structural steel and 96,000 brick. More than 255 tons of machinery and switch gear were hauled five miles from the railroad station over ordinary country roads which made a load limit of fifteen tons necessary. This required the generator rotor and transformer to be shipped unassembled. The total cost will be about $100 per horsepower. This cost includes all switch gear and substation apparatus aggregating more than $50,000.

Next May or June it is planned to test the new unit

by the salt velocity method, and it is expected that the results of this test will be published.

The conception, general layout, design and execution of this development are the work of the Cumberland County Power & Light Company's own engineering forces. The preliminary plans were checked by A. Streiff, consulting engineer, Jackson, Mich. The Foundation Company of New York did the construction work and made working drawings from the power company's designs, all under the supervision of the owner's engineers. All substation and control equipment was placed and wired by the power company's crew. The waterwheel and generating equipment was installed under the supervision of erectors furnished by the respective manufacturers.

Letters from Our Readers

Answers Objectors to Article on Supplanting Oil Engines with Purchased Power

To the Editor of the ELECTRICAL WORLD:

Both of the letters which have appeared in the ELECTRICAL WORLD* criticising the article on supplanting oil engines with purchased power can be answered at once.

Referring to the second paragraph in the letter from the Foos Gas Engine Company relative to depreciation of the engine: At the time this report was made the customer stated that he intended to write off the investment in the engine and to forget it.

Referring to third paragraph: The company's operating man has told me that since it discontinued the use of the engine it has saved virtually the whole time of one man.

Replying to fourth paragraph: As a matter of fact, the cooling water was allowed to run to waste, and I feel that if any one was at fault for not recommending a cooling tower, it was the engine manufacturer or consulting engineer who installed same.

Referring to the fifth paragraph: I would say that the test referred to was made by the engineer who installed the engine and not made at the time of our later investigation, from two and a half to three years later; and the reason we had to estimate was that a portion of the oil used at the plant was used for heating purposes and a portion for the engine, therefore it was impossible to determine accurately the exact amount used by the engine. Hence it was estimated at what was considered a reasonable figure by checking the summer oil consumption against the kilowatt-hours produced.

As mentioned in the published report in the ELECTRICAL WORLD, the average oil consumption must be based on varying conditions, while the test was made, as stated, under ideal conditions. As further indicating that these figures are not far from correct, the customer feels that the actual results obtained since shutting down his engine are coming considerably within the estimates.

Referring to the sixth paragraph: Any one familiar with power rates knows that if the consumption can be extended over long periods of hours, the investment in generator capacity and transmission lines is used to its fullest advantage and a customer operating on a two-part rate will in this way earn a very low rate. That is what happens in this particular case. Since shutting the engine down, his load operating over long hours earns him a lower rate than the short-hour standby service could earn.

In conclusion, there is no intention in submitting this report to antagonize the engine manufacturer; but it is merely to supply data which would be of interest to users of power, as indicating that the claims for oil-engine operation efficiencies are not always justified.

I think the best proof, after all, of the fairness of this estimate is the fact that the customer has informed me that it is working out to give a larger average saving throughout the year than we estimated. I will say, however, in justice to the engine people, that the full amount of the actual saving the plant is making is probably not entirely due to the shutting down of the engine, because at the same time some other small changes were made in operating methods, and these to a certain extent contributed toward increased efficiency.

The fact that these changes were made makes it impossible for us to check the estimates of our report exactly, but the customer does state that he is well pleased with the fact that the engine has been shut down, and I presume that in addition to the savings made the collateral benefits have contributed somewhat to satisfaction. Some of these are less vibration, less noise and a cooler engine room, which saves on the amount of refrigeration required.

The fact remains, too, that while the engine was in service there was more or less difficulty with its operation, caused by such mishaps as a broken cylinder head or a flooded oiling system, etc.

UTILITY POWER ENGINEER.

*March 26, 1927, page 660.

More About 110-Kv. Cable

To the Editor of the ELECTRICAL WORLD:

Your issue of Feb. 5 contains a description of 110-kv. cable supplied by the Felten Guilleaume Carlswerk A. G. to the Rhenish Westphalian Electricity Supply Company and displayed recently at Düsseldorf. I find, however, that that description is not quite complete and does not mention, for instance, that the cable referred to belongs to the type of cable known as "H-type cable." A special feature of the "H-type cable" is that around the insulation is wound, in spirals joining each other, a very thin coat of aluminum (0.015 mm. thick), perforated all over with very fine holes so as to allow impregnation. The metal sheath so formed is applied to the insulation so perfectly that air bubbles between the insulation and the metal are virtually out of the question. With an ordinary cable one is never quite sure that in the manufacturing process of the cable air pockets have been avoided between the lead sheath and the dielectric, giving rise to ionization and finally causing a breakdown of the cable. This metallizing" of the insulation of the cable tends greatly to render the cable nearly perfect; consequently this process has now been almost universally adopted for very high-tension cables, for instance, at Arlbergbahn, (Austria), rating 60 kv.; Zürich (Switzerland), 50 kv.; Holland, 50 kv.; Newcastle-on-Tyne, 66 kv.; Duquesne Light Company, Pittsburgh, 66 kv.; Commonwealth Edison Company, 75 kv.; Rhineland, (Germany), 110 kv.; Commonwealth Edison Company, 132 kv., and Public Service Electric & Gas Company, 132 kv.—all alternating current.

R. BARRAT,
Brussels, Belgium Cable Engineer.

Central Station and Industrial Practice

Distribution Transformer Installations

THE standard practice of the subsidiary companies of the Southeastern Power & Light Company operating in Alabama, Florida and Mississippi covering the installation of 2,300-volt distribution transformers is shown in the accompanying illustrations. Single transformers of 3-kw. and 5-kw. capacity are hung on single crossarms (Fig. 1). Single transformers of 7½ kw. and 10 kw. are hung on a single arm placed 18 in. below the lowest primary line arm (Fig. 2). Installations of two transformers, 5-kw. to 10-kw. capacity, are hung from standard double arms (Fig. 3).

Installations of from one to three transformers rated at 15 kw. to 37½ kw. and single transformers rated at 15 kw. to 50 kw. are hung from special double arms (Fig. 5). Installations of two or three transformers of 75 kw. or larger are placed on standard structures (Fig. 6).

All transformers are stenciled with an identification number and rating (Fig. 4), the initials of the company being placed on the transformers only when installed on private property. No transformers are installed on corner or junction poles or on poles supporting arc-lamp brackets.

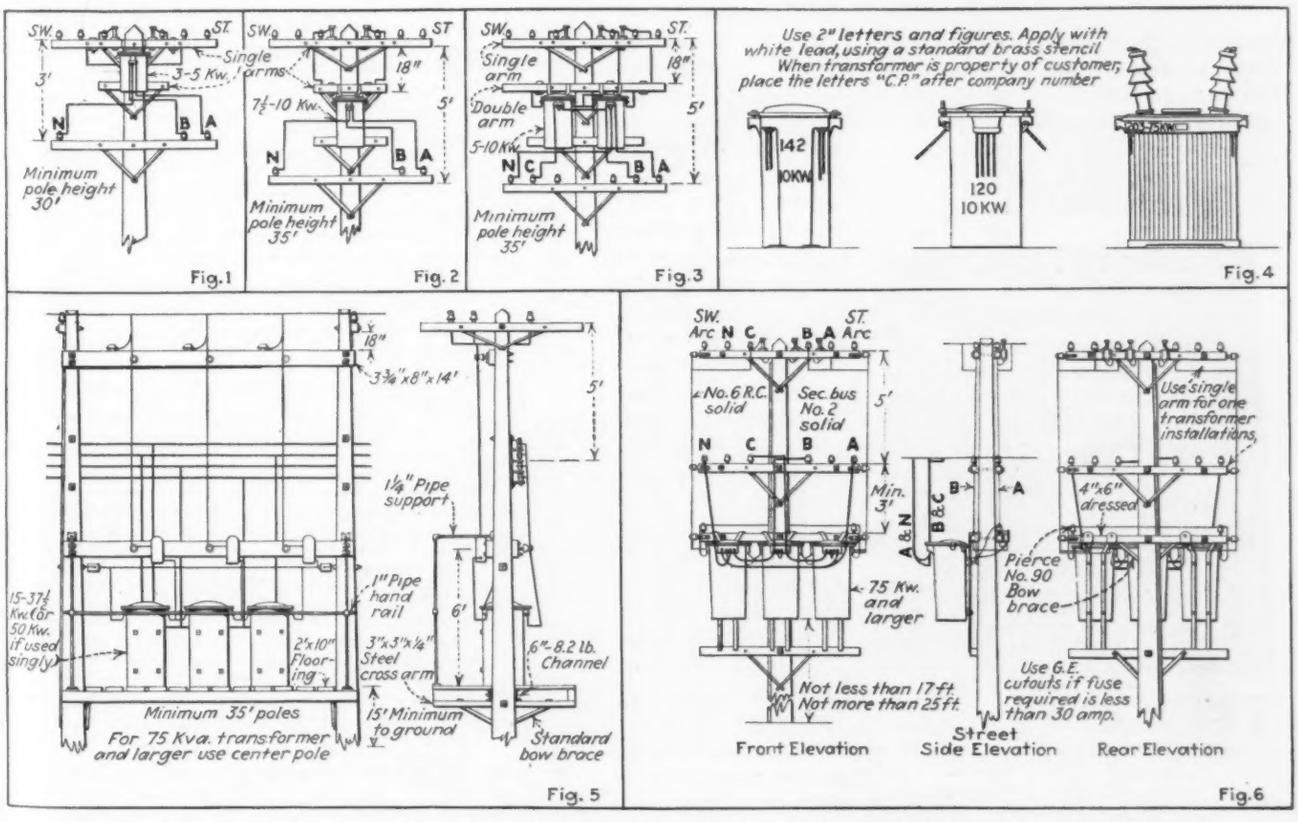
For three-phase service from 2,300-volt/4,000-volt lines, with demands up to and including 30 kw. total, two transformers connected in open delta or opened Y on the primary side are used. For single-phase transformers two fuses are installed. Where two or more transformers are installed in a bank, three fuses are used. On four-wire, three-phase installations the neutral is connected without fuses.

Metallic Dust Between Slip Rings Causes Flashover

FLASHOVER of rotary-converter slip rings in both automatic and manual substations directly after turning down and shaping up the rings was the cause of considerable perplexity to the construction and maintenance department of one power company until the trouble was located and corrected. Three such failures in different substations have been experienced.

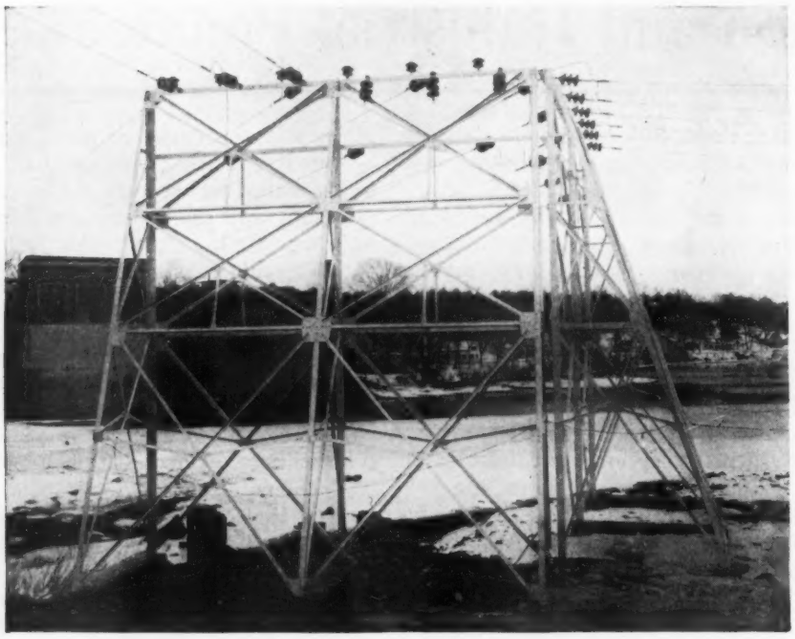
The first occasion was at an automatic railway substation. After the rings on the rotary converter were turned, the rotary was thoroughly blown out and put in service. Everything seemed to be normal. The following morning it was reported that the rings were badly burned and so bent up that it was impossible to determine the exact cause. These rings were replaced and have operated without any further mishaps.

Next the rings at another automatic substation several miles farther on were turned and the same trouble was experienced. It was thought then that the trouble might be due to moisture condensation on the insulation between the rings as a result of changes in temperature. Consequently fans were placed to



FIGS. 1 TO 6—TYPICAL TRANSFORMER INSTALLATIONS USED BY THE SOUTHEASTERN POWER & LIGHT COMPANY

Terminal Structure Using Relatively Little Steel



STEEL was saved by this design of tower, which receives four 38-kv. three-phase lines of 380-ft. span over the Saco River at West Buxton, Me., and deflects each of the two pairs about 90 deg. as they leave the river bank. The tower was erected in two wings on concrete foundations with axes practically at right angles. Suspension disks in strain, combined with short jumpers, make an unusually convenient angle turn possible with the phase wires. The common square tower was eliminated in this way. The structure was designed by the Cumberland County Power & Light Company.

blow on the rings and it was felt that the trouble had been overcome.

The next job, however, was at a manually operated station, where the same trouble developed except that the damage was not so great and an opportunity was afforded to study the nature of the burn, diagnose the trouble and ascertain what caused the failure. It was found that the insulation between the rings was hard and dry, making them very porous. As a result the insulation caught and retained some of the dust from the rings while they were being turned and the deposit could not be blown out because it was underneath the cord binding strings. As the brushes wore in on the new rings, a certain amount of additional copper dust from the rings and brushes accumulated underneath the stud that runs through the rings. During the rotation of the rotary centrifugal force caused this dust to short-circuit the two rings. Correction of the trouble was handled in the following manner:

Some ½-in. varnished cambric tape was wound over the cord between the rings, this building up a small V-shaped form in the center of the space between rings, which gave a windage effect, throwing off any dust that might collect. Also all the insulation between the rings was painted three or four days before attempting to turn the ring. This gave it a smooth surface, making it easy to wipe off the dust and dirt that might accumulate after turning the rings. After the rotary had been in operation three hours it was again blown out. This procedure was kept up for 24 hours, after which the machine was turned over to the operator as O. K. for regular service.

Plant Data Board

THE board here shown is hung in the turbine room of the Cahokia station of the Union Electric Light & Power Company of St. Louis. Block letters are used so that the data may be changed as operating conditions vary.

Open-End Envelope Used for Meter Record

BY H. A. CLARKE
Norwich, Conn.

IN THE earlier days of meter work, especially on small properties, the limitations of the bound-volume type of record led to the use of the card system, but in many cases the

METER TEST

Street
District
Name
Address
Location

Ave.
Dial Con.
Disk K
P. T. Ratio
C. T. Ratio
Test K
Amps
Volts
Phase

Mfg. No.
Style
Co. No.
Wire
Supplying
Room
Floor

INSPECTION

METER	CHECK
Glass	
Register	
Top Bearing	
Jewel	
Pivot	
Disc	
Magnets	
Creep	

GENERAL

Is Neutral Ground on Premises?
Is Grounded Lead in Proper Meter Terminal?
Should Meter Be Changed?
Is Meter Location Proper?
Would General Appearance Indicate Tampering?
If meter cannot Be Tested State Reason?

TEST DATA

	ELEMENT	LOAD	OBSERVED REVOLUTIONS STANDARD [A]	OBSERVED REVOLUTIONS METER	TRUE REVOLUTIONS STANDARD [B]	TRUE REVOLUTIONS METER	ACCURACY B/A - %	STANDARD NO.
AS FOUND								
AS LEFT								

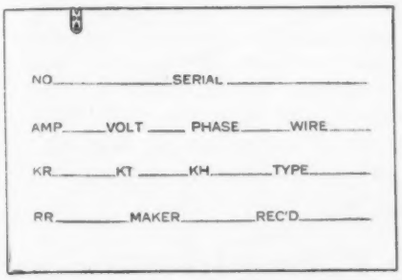
Time Entered Premises — Time Leaving Premises
Seal No. — Found — Left — Kind of Test
Remarks

Time of Test Hrs. Min's
Date 192 Tester

FOR DIAGRAMS ETC., REVERSE CARBON SHEET AND WRITE ON BACK OF REPORT

FORM OF TEST RECORD

latter was introduced in forms that required considerable clerical labor and that were more or less complicated. When the Norwich lighting department needed a better system for the 4,500 meters then in use, the envelope-type of record outlined herewith was adopted, and it is giving



FACE OF METER RECORD ENVELOPE; CLIP COLOR SHOWS YEAR OF LAST TEST

excellent service today with approximately 7,800 meters.

In this system a heavy open-end envelope, 3x5 in., is employed. On the face of the envelope are kept all the data pertaining to the meter, and on the reverse side is kept the location of the meter with dates of setting and removals. Notes on tests are kept on a slip placed in the envelope, and on top of the latter a fastener indicates by its color the year in which the meter was last tested and shows at a glance the meters due for present test. The only clerical work required is changing the address and date when the meter is removed.

Electric-Truck Hoist Handles Transformers

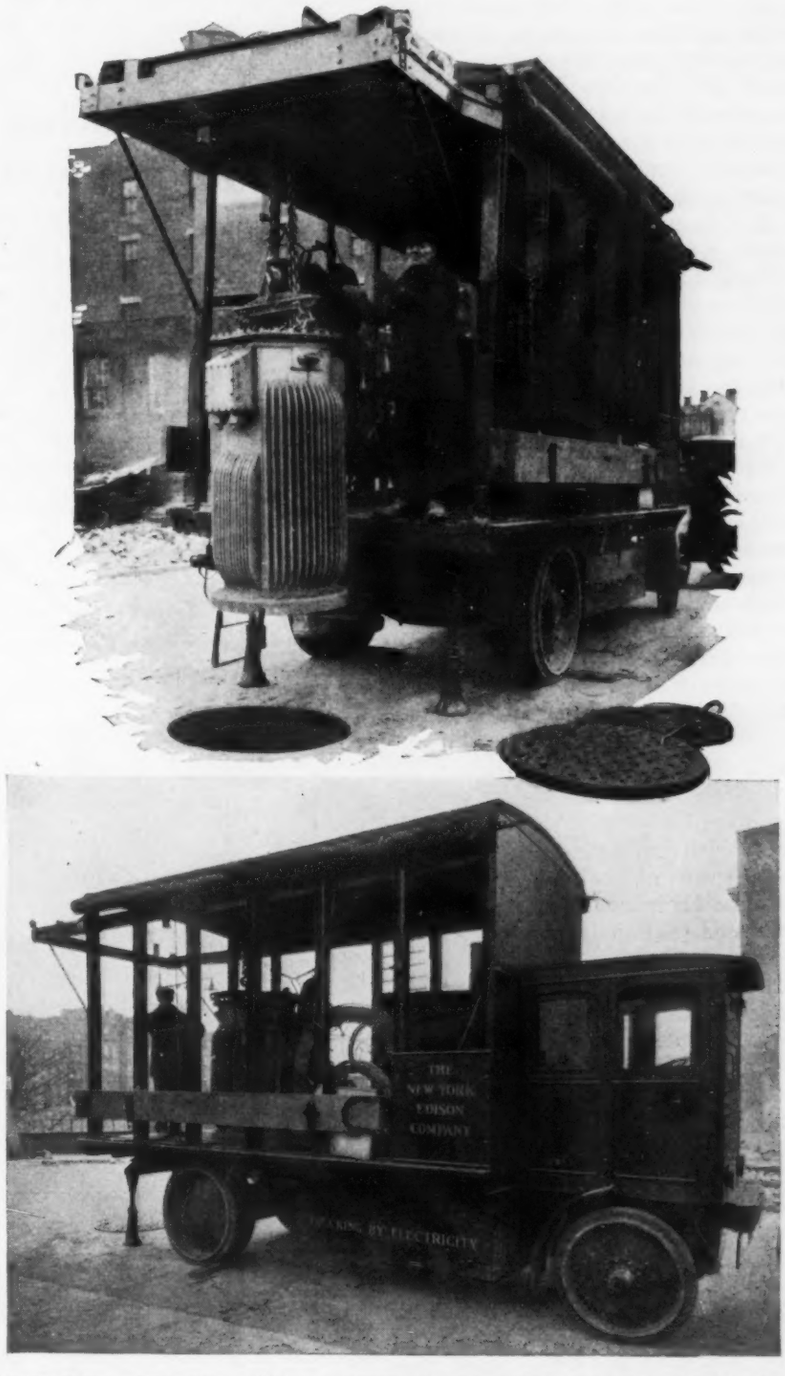
FACILITIES for lifting as much as 4,000 lb. are provided by one of the latest electric trucks purchased by the New York Edison Company. A traveling electric Yale hoist is supported on 6-in. channels extending the entire length of the truck and 4 ft. beyond the rear of the superstructure. Electric current for the crane as well as for truck propulsion is supplied from a 44-cell, 25-plate "Ironclad" battery. The truck itself is a 6-ton Walker vehicle.

Transformers of 150-kva. capacity, 80 in. in length, weighing 3,600 lb., are easily handled with this equipment. Formerly such work required several men and many hours of labor. Now, however, the work is accomplished by two or three men in a few minutes. This is claimed to be the first truck of this type to be placed in commission and the results that have been obtained are said to be most promising.

A Stimmel electric winch of 18,000 lb. direct pulling capacity equipped with a General Electric type controller is also provided on the truck for pulling cable and other heavy-duty types of work.

Two control handles are used for the crane, one for raising and the other for lowering operations. The controller returns to the neutral or off position the moment the idler handle is released. A powerful brake is interlocked with the controller in such a way that when the current is applied the brake arms are released or when the current is cut off the brake action is practically instantaneous.

The truck body and the steel superstructure were constructed by the Shadbolt Manufacturing Company. Such standard equipment as an idler pulley, skids, horses and steady jacks are included.



TRANSFORMER WEIGHING 3,600 LB. BEING LOWERED QUICKLY AND EASILY INTO A MANHOLE FROM THE CRANE-EQUIPPED TRUCK. LOWER VIEW SHOWS ELECTRIC TRUCK EQUIPPED WITH SUPERSTRUCTURE FOR OPERATING A CRANE

Commercial Activities and Public Relations

Lamp Committee Makes Recommendations

THE lamp committee of the National Electric Light Association again draws attention in a serial report issued recently to the disadvantageous results growing out of the use of carbon filament lamps. It recommends that member companies arrange for the introduction of new rough service Mazda lamps in connection with a satisfactory guard in garages, construction work and other places where heretofore the carbon lamp has been employed by reason of its superior ability to withstand shocks and bumps. Where vibration is serious, the use of one of the vibration-absorbing devices now on the market is recommended with the larger-sized lamps. Wherever carbon lamps are used in ordinary lighting service merely because of their low first cost or unusual bulb shapes or coloring, the committee considers it desirable to provide means for readily demonstrating the relatively high consumption of these lamps and their consequent high cost per unit of light produced.

Operating companies are urged by the committee to adopt some one of the following suggestions to convince the ultimate user of carbon lamps of their lack of economic value:

1. Show stores and agents supplying these lamps that they are inefficient, with the expectation that the better grade of chain stores will discontinue their handling if they are convinced that their advocacy is improper.

2. Request any stores which take the attitude that they are meeting the public demand to post placards and supply to them any literature chosen from the N.E.L.A. suggestions pointing out the lack of economic value in the use of carbon lamps.

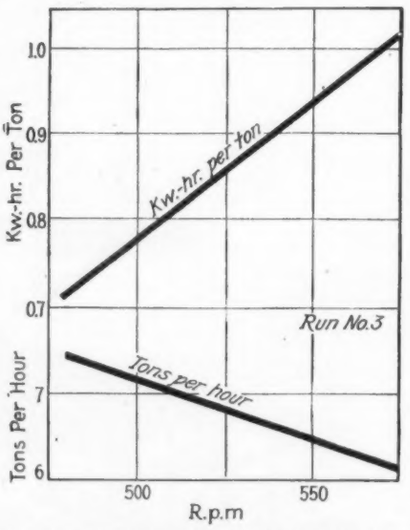
3. Follow the established policy of using quotations on bills, inclosures with bills, circulars, newspaper advertising, and so forth, to reach the ultimate consumers of carbon lamps to demonstrate their low efficiency.

Electric light and power companies are urged to put into their showrooms and district offices means for comparing the current consumption of carbon with tungsten filament lamps, with proper tables of costs figured on the company's own rate, to show the difference in cost of producing the same quality of light. Likewise it is urged a statement be sent users on power company lines who have heretofore used the carbon lamp because they felt that it had fulfilled a legitimate demand in certain places, such as on the end of trouble cords, in garages, etc., informing such customers that there is now available a tungsten filament lamp that gives better service for every use, with the possible exception of resistance or heating purposes, than do carbon lamps.

Reducing Silo Filling to a Small Motor Job

BY HOWARD C. FULLER
Rural Service Division
Utica Gas & Electric Company, Utica, N. Y.

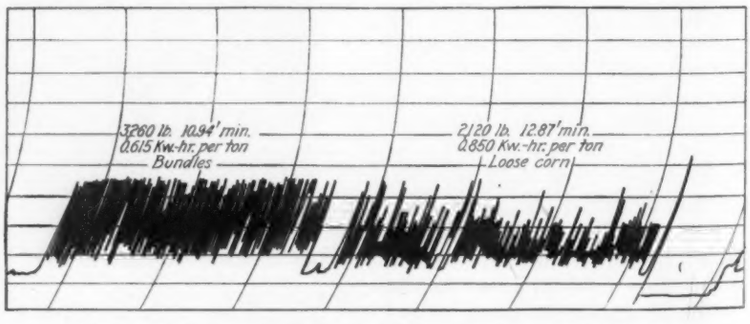
THE Utica Gas & Electric Company has been co-operating with the New York State College of Agriculture at Ithaca, N. Y., in running a series of tests using a portable farm 5-hp., 220-volt, single-phase motor. A fairly comprehensive conception of the arrangement of the equipment for those tests can be obtained by referring to the frontispiece contained in this issue (page 696).



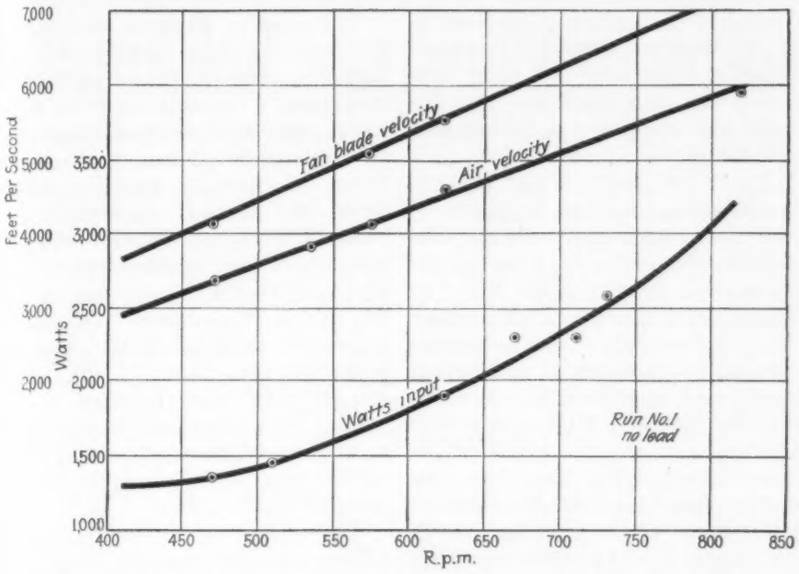
ENERGY CONSUMPTION AND RATE OF CUTTING ENSILAGE USING 5-HP. MOTOR

The first object of this experimental work was to determine the characteristics of an ensilage cutter of the radial blade type and of efficient design when running under no load. Previous experience has shown the importance of obtaining the correct speed of the cutter.* Power was transmitted through a 50-ft., 4-in., four-ply rubber belt. The motor was mounted on a two-wheel truck and was provided with a thermal cut-out device and a push-button starter on a 25-ft. cable. By using various sized pulleys a complete run was made, the results of which are shown on the accompanying curves. The "watts-input" curve is particularly important, as

*A year ago the Utica Gas & Electric Company began the study of silo filling with electric motors for power. The results of this work were reported in the ELECTRICAL WORLD of July 10, 1926. The motor used on these preliminary experiments was 20-hp., three-phase.



POWER DEMAND ON 5-HP. UNIT WHILE CUTTING AND ELEVATING BUNDLED AND LOOSE CORN



RELATION OF FAN-BLADE VELOCITY, AIR VELOCITY AND POWER INPUT TO SPEED OF ENSILAGE CUTTER

it indicates the rapidity with which the power required to operate the ensilage cutter increases as the velocity of the blades is increased.

A second run was made to determine the most practical operating methods for the outfit and to learn something of the best methods of feeding the corn. This work was accomplished by trial and error methods and the final speed range was reduced to from 575 r.p.m. to 410 r.p.m. These speeds are considered to cover the practical operating limits of the outfit. In this connection it was interesting to note that when a high pulley ratio was used, the minimum current consumption reached under a heavy load was lower than when a lower pulley ratio was employed.

Characteristics of Load Investigated

The third run was made to determine the practical characteristics of the outfit under load and also to study the load characteristics with bundled corn and loose corn. The recording watt-meter chart shows the importance of having the corn bound in bundles. This run indicated that the slowest speed at which the blower would elevate the corn into the silo was the most efficient speed, both as to the tons per hour cut and the kilowatt-hours required per ton. A pulley ratio which gave a no-load speed of about 480 r.p.m. was the best and the cutter operated more satisfactorily equipped with two knives than with three.

Another run was made under ordinary operating conditions with the outfit set up to operate according to the best characteristics shown by the previous runs. The results are shown in the accompanying table.

DATA OF TEST RUN APPROXIMATING IDEAL CONDITIONS OF OPERATION

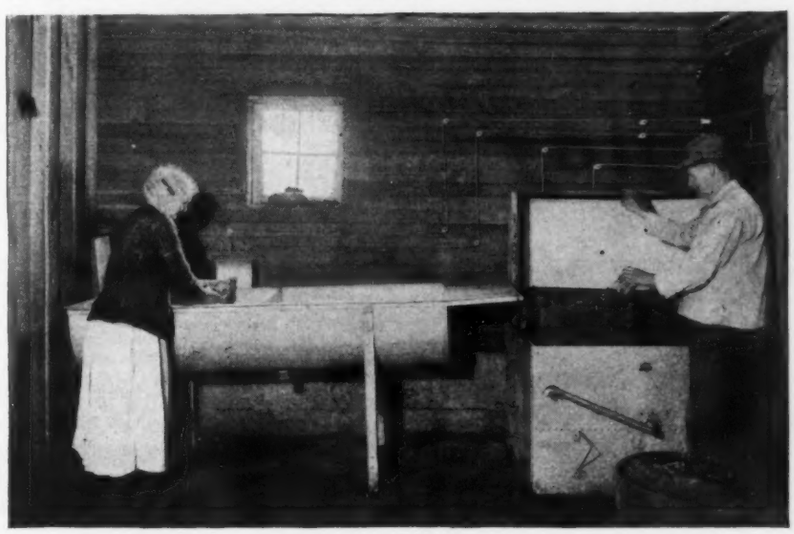
Total running time	20 hours, 10.5 minutes
Actual cutting time	17 hours, 54.7 minutes
No-load running time	2 hours, 16.3 minutes
Average unloading time	12 minutes
Average tons per load	1.31
Total tons cut	154.97
Tons per hour, running time	7.34
Tons per hour, cutting time	8.00
Kilowatt-hours per ton	0.665
Horsepower-hours per ton	0.887
Average load on motor, hp	5.71
Average overload on motor, per cent	14.5
Cost per ton at 5 cents per kilowatt-hour, cents	3.325

Future for Small Motors

These tests seem to indicate a very important development in rural electrification, as they point out the possibility of reducing large power jobs to such operating schedules as will make it practical to use much smaller motors than is the practice at present. Whereas it had been thought impossible to do good work in filling silos using a small motor unit, these tests were carried out under actual farm conditions and were of sufficient duration to give accurate results. Furthermore, the work done was entirely satisfactory. A rate of eight tons per hour is sufficient for most farms in the East and is very nearly as fast as the ordinary organization on the farm can prepare and deliver the corn to the ensilage cutter. To secure a comparison, a 20-hp. tractor was belted to the same cutter and showed only ten tons per hour under the same operating conditions.

Adding silo filling to the possibilities of a small electric motor helps to justify the expense of this utility unit, which can be used for many other purposes on the farm, such as wood sawing, pumping, grinding, etc.

Electric Sterilizer and Bottle Washer Aid Dairymen



DAIRYMEN in western Washington are finding that electric sterilizers and bottle washers such as that illustrated not only save them money but much labor as well. This dairyman reports that he cleans and sterilizes milking utensils for 28 cows and washes his milk bottles at a cost of $10 to $13 a month, whereas a neighbor with about the same sized dairy spends $12 a month for fuel alone for a fuel-fired sterilizer, to say nothing of fire risk, greater trouble and more labor. The sterilizer was furnished by the De Laval company and the bottle washer, consisting of a small motor with spiral brush, is sold by many dairy supply houses.

Insurance Protection of Time Payments

BY M. K. PINKERMAN
Advertising Department, Commonwealth Edison Company, Chicago, Ill.

CUSTOMERS purchasing large appliances receive added protection under a system of insurance recently inaugurated by the Commonwealth Edison Company. Previously many customers hesitated to purchase appliances on the partial payment plan because of their uncertainty regarding their ability to make future payments. To overcome this "fear of the future" an arrangement has been made with the Federal Electric Company for the issuance of payment protection certificates, to be given all customers buying a washer, cleaner or ironing machine made by that company.

This plan guarantees the payment of the customer's obligation in the event of illness of fourteen days or more in any one month, or the payment of the entire contract in the event of the accidental death of the individual named as the chief wage earner of the purchaser's family. The basis of the plan is really the safeguarding of the customer's accumulation of wealth, which it protects against the gnawing of time payments when such customer's regular income has stopped due to sickness or disability.

If the "individual named," because of accident or disease, is unable to work for fourteen days or more, the indemnity company will keep up his installments, prorating its share of the payment according to the number of days of disability of the individual in question. Payment is made from the first day of disability. For example, if there is a $10 payment due on an appliance and the purchaser is ill for fifteen days, the indemnity company pays $5, or half the monthly amount due. If the purchaser is ill for a month, the indemnity company meets the entire monthly installment. If unable to work for a longer time, all payments falling due during his period of disability will be met.

The important feature of the plan to the purchaser is that he does not have to make up any payments made by the indemnity company. His account is credited by the Edison company for the amount paid, closing the transaction.

The plan is likewise beneficial to the central station employing it. Its primary purpose, of course, is to increase sales by reducing sales resistance. But it does more than this—it eliminates excuses and cancellations of contracts formerly arising from the illness or disability of "time" purchasers and simplifies central-station bookkeeping, collections and credit adjustments by making part-payment sales in such cases practically equivalent to cash sales from the standpoint of security to the central-station company.

This protection entails no increase in the cost of the merchandise either to the retail customer or to the Edison company.

The protection certificate plan stabilizes installment selling by eliminating, to a considerable extent, the economic fear-of-the-future hazard. "You pay when you're well, we pay when you're not," is the slogan and spirit of the agreement.

Advertising the Service Value of Electric Refrigeration

A story told
in a Pullman smoking compartment
that everyone can read
On April 29, 1926, two men sat in the smoking compartment of one of the Pullman cars of the Twentieth Century express to Chicago.
One was an Easterner on a business trip west. The other, it proved, was from Los Angeles, on his way home. "If I may ask," said the Easterner, "what brought you so far east?" "Lamb," replied the other.
"Lamb?"
"Yes, sir. Lamb. I'm with the——————Packing Company. We sent a trainload of lamb from Los Angeles to one of your big Eastern cities. Arrived five days later. I came on to see everything was ship-shape."
"Do you mean to tell me," asked the Easterner, "that the lamb I eat comes from Los Angeles?"
"Might come from farther away than that. While I was checking up on our lamb, I saw some lamb in the same city from New Zealand."
"Lamb from Los Angeles and New Zealand?" exclaimed the Easterner. "On the level, now, is it good?"
"Absolutely," replied the other. "It's kept in perfect refrigeration until it's delivered at your door."
The Easterner made further investigations. He learned that most of the food we eat comes hundreds and thousands of miles. Such food is kept in perfect refrigeration — until it is delivered to our homes. But such food — unless it is kept in a proper state of refrigeration — deteriorates much more readily than fresh food.
So that man has already had installed in his home a Servel electric refrigerator. He realizes that old-fashioned methods of refrigeration are not efficient under new modern conditions. He knows that electric refrigeration is necessary to-day to protect food and to guard the health of his family.
We'd be glad to install a modern electric Servel refrigerator in your home. Only $10 down, 2 years to pay the balance. Just 'phone us to send a man to tell you about convenient, certain, efficient, economical electric refrigeration.
Telephone Mont. 324—Barre 246-R.
Montpelier & Barre Light & Power Company
Do It Electrically

30,000 miles!
The food for your dinner traveled that distance to reach your table
The food for an ordinary dinner represents thirty thousand miles of transportation!
This fact—a fact of tremendous significance—was revealed a few weeks ago by a prominent engineer at the great meeting of economists held annually in Williamstown, Mass.
The food you eat travels thousands and thousands of miles before it reaches your table. That food is properly protected on its long journey. But food that has once been in a state of refrigeration deteriorates more rapidly than other food—unless it is maintained in proper refrigeration.
Food that has traveled thousands of miles must be carefully protected from the time it reaches your home until it is served on your table. Modern conditions of food distribution make necessary new and better methods of refrigeration in the home.
Electric refrigeration has been developed to meet the new needs. Electric refrigeration gives dry cold—gives lower temperature than old-fashioned methods—gives constant temperature. And we make it easy for you to enjoy this new electric service. We will completely install Servel electric refrigeration in your home for $25.00 down. 18 months to pay the balance.
Telephone 1550
Fitchburg Gas & Electric Light Company
Electric Refrigeration means CONSTANT COLD

TWO New England power companies' electric refrigeration advertisements, reproduced herewith, feature effectively the value of such service in long-distance preservation of food products and draw striking parallels in which the application of refrigeration in the home is emphasized as a health-promoting measure. This hygienic viewpoint is more and more coming to the front in the "sale" of the electrical refrigeration idea to the general public; it was the keynote of the 1926 Boston electric refrigeration show, and is being stressed even more than the economic advantages of "ice by wire" or any one of a number of other slogans in vogue.

Good Will Created by Aiding Civic Affairs

AN OUTSTANDING move in public relations work was made by the Washington Water Power Company, Spokane, Wash., in February, when that company donated the time and experience of W. H. Ude, director of public relations, to act as full-time director of a Community Chest campaign, which was successfully closed in the allotted time.

Taking the place of the paid professional campaign director, Mr. Ude organized 1,000 men and women for the campaign and raised $225,500 in eight days. In addition to his services, extending over a period of four months and taking all of his time for six weeks, the Washington Water Power Company made the largest subscription to the fund, its employees made a 100 per cent contribution and a campaign team under L. K. Snyder, a salesman, consisting entirely of other salesmen of the company, for two consecutive days led all other teams in the number and amount of subscriptions. The Community Chest drive proved to be like any other sales job where it takes salesmanship to produce the most satisfactory results.

This co-operation with an outstanding civic undertaking drew city-wide commendation for the Spokane utility, and the public good will created has inestimable value.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Pleasing Architecture for Hydro-Electric Plants.—Y. GIRARD.—As a rule little attention is paid to the architectural appearance of hydro-electric stations, although they are frequently built on sites which are visited by tourists. Many French and Italian plants, the author demonstrates, can, with small additional attention and skill, readily be built to harmonize with their natural surroundings. As outstanding examples of what has already been accomplished exterior views are given of the French Verne and Bâton stations and Italian plants at Crego, Verampio, Pallanzeno, Grossotto, Roasco, Fadalto and Venaus. Nearly all of these plants are built of cut stone and, with their beautiful landscape gardening, are an adornment rather than a detriment to the natural surroundings. —*Revue Générale de l'Electricité*, Feb. 12, 1927.

Geared Turbines in Jute Mills—An interesting example of modernization of plants is provided by alterations recently completed at the Reliance jute mill, near Calcutta, India. The alterations consist in the installation of a steam turbine of 4,500 b.hp., probably the most powerful geared turbine ever installed for textile work, to replace two large reciprocating engines by which the mill had previously been driven. Among other interesting features of the installation is the fact that although the work was carried out under great difficulties, due to local conditions, the new plant was installed and the conversion effected without any interruption of the working of the mill, which has at present 1,000 looms and 20,000 spindles. Previously the mill had been driven by two mill engines of 2,500 i.hp. and 1,500 i.hp. respectively. —*Electrician* (*England*), Feb. 25, 1927.

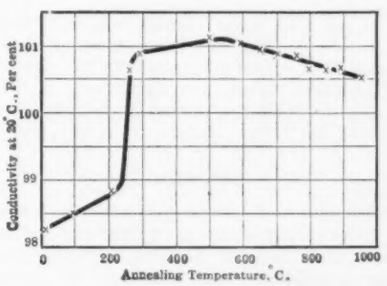
Transmission, Substations and Distribution

Use of Stoneware.—F. SINGER.—Comparatively little use has so far been made of stoneware for technical purposes, such as electric insulators, for example. Porcelain has always unreservedly had the preference. In this article the author describes the chemical and mechanical properties of these two ceramic materials, coming to the conclusion that they should not be considered as competitors, but that the size of the object determines their selection. Small, one-piece goods, like low-voltage and medium-voltage insulators, should be made of porcelain, while tall high-voltage leads, which would have to be made of several porcelain pieces, are more economically made of stoneware. In one respect porcelain has a decided disadvantage over stoneware. The glaze which is commonly applied on porcelain is a different material from the porcelain itself, and unless the expansion coefficients of the two are the same or nearly the same, cracking of the glaze will result. To close the surface pores of stoneware the so-called sodium-chloride process is used, whereby salt, thrown into the firing kiln, causes a very fine film to form over the surface of the goods. It has been proved that this century-old process affords a most excellent surface protection and positively avoids crackings.—*Zeitschrift des Vereines Deutscher Ingenieure*, Jan. 22, 1927.

Stability of Large Power Systems—F. H. CLOUGH.—The author defines the stability of a system as its ability to respond to the power demands for which it was designed, or its ability to maintain voltage under the varying condition of loads involved. He then proceeds to discuss conditions of power instability that are desirable, the necessity for limiting the fault current and the proposition of tap changing under load.—*Electrician* (*England*), Feb. 25, 1927.

Heat Applications and Material Handling

Relation of Annealing Temperature to Conductivity of Copper Wire.—J. C. BRADLEY.—This paper deals with the relation of annealing temperature to conductivity of copper wire, which the author claims has been definitely determined. The work which is described was done on high-grade electrolytic copper containing 99.942 per cent copper plus 0.0008 per cent silver. The wire was hot-rolled to ¼ in., then cold-drawn to 0.08 in., cut into 25 5-ft. lengths and numbered 1 to 25 as cut for testing. Four samples were tested



RELATION OF ANNEALING TEMPERATURE TO CONDUCTIVITY OF COPPER WIRE

hard. The others were wound into 5-in. diameter coils. The graph shows the relationship which was established between the annealing temperature measured in degrees centigrade and the per cent conductivity at 20 deg. C.—*Wire and Wire Products*, March 1927.

Generation, Control, Switching and Protection

Mixing of Oils.—F. FOERSTER.—Operating companies keep a supply of oil on hand to maintain switches and transformers in proper condition. Frequently several brands of oil are stored and necessity, economy or emergency forces the operator to mix them. The property of such an oil mixture is rarely known beforehand. The author undertook tests with various oil mixtures, and he came to the conclusion that the electric properties of the individual oils are not impaired, provided only mineral oils are mixed. He did find, however, that sludging may, under certain circumstances, be increased. It is suggested to subject both oils to the benzine test before they are mixed, and only if they pass the test without pronounced sludging can they be safely mixed.—*Elektrotechnische Zeitschrift*, Jan. 13, 1927.

Overload Relay.—L. J. GIRARD.—The direct-action relays, formerly much used, which were mounted on high-voltage circuit breakers, were abandoned because their relay coils were a frequent cause of trouble. To make them act positively a relatively large number of ampere-turns was necessary, which, in turn, gave the coil such a high impedance that they failed to function under short circuit. A novel relay of this type is described which is so constructed that the number of required ampere-turns is only one-tenth of the former amount. For example, a 5-amp. relay has only 20 turns of ribbon copper on its coil, the ohmic resistance of which is but 0.006 ohm. Similarly only ten turns are required for the 10-amp. relay, and only one turn for the 150-amp. type. The magnet core is a laminated iron cylinder out of which a sector has been cut. This cut-out sector acts as the moving armature. Owing to the favorable shape of the magnetic circuit, very considerable attractive force can be obtained, in spite of the small number of active ampere-turns. Overload and short circuit tests on this new type of relay proved very successful. For example, the 10-amp. relay was subjected to "shorts" up to 7,000 amp. without any deformation or a flashover of the relay coil.—*Revue Générale de l'Electricité*, Feb. 5, 1927.

Units, Measurements and Instruments

Impedance of a Rotating Synchronous Machine to a Negative Sequence Voltage.—C. F. WAGNER and A. DOVJIKOV.—At the bottom of all fundamental relations for polyphase current voltages is the assumption that these currents and voltages are balanced or symmetrical, that the vectors representing these values are of equal magnitude, and that the angle between vectors is constant and equal to 360 deg. divided by the number of phases. The author, for simplicity, considers only one polyphase system—the three-phase. The rest of the paper contains a mathematical treatment of the subject, using a method of symmetrical co-ordinates in which the values of distortion can be replaced by a system of negative (or negative and zero) sequence voltages. These, combined with a normally existing system of positive sequence voltages, give a picture of the system during disturbance.—*Electric Journal*, March, 1927.

Significance of the Dielectric Constant of a Mixture.—H. H. LOWRY.—In many cases it would be of great value to be able to calculate either the dielectric constant of a mixture of sub-

stances of known dielectric constants or, knowing the dielectric constants of a mixture of two components and that of one of the components, to calculate the dielectric constant of the other. Following a review of the formulas applicable to the problem, the author gives a brief account of the results of experimental investigations on the dielectric behavior of mixtures. The experimental data are divided into the following sections: (1) Liquid-liquid mixtures; (2) electrolytic solutions; (3) non-electrolytic solutions; (4) colloidal solutions; (5) mixtures showing a high degree of heterogeneity, such as powders in air. A bibliography is appended to the article and references throughout the paper refer to this list. —*Journal of the Franklin Institute*, March, 1927.

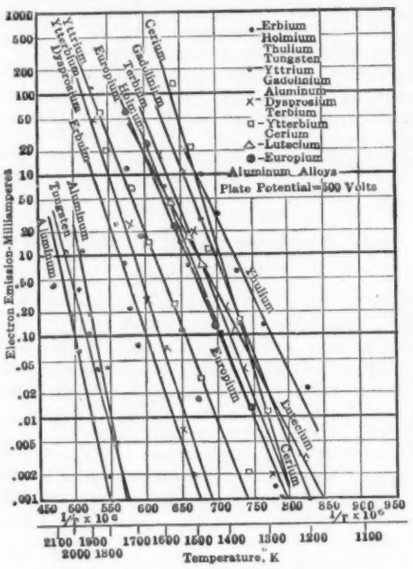
Motors and Control

Textile Electric Drive Development.—FRANK NASMITH.—Innovations of importance are not common to the textile machinery industry, according to the author of this paper, but recently there have taken place a number of developments which mark a very distinct advance on existing practice in this field. Before describing the more recent applications of electric drive a brief résumé is give of the trend of development in the cotton industry and its machinery. The chief objections mentioned to the individual drive for textile machines have been that many small induction motors have a low efficiency compared with the large ones, and also that their starting is too quick and severe for the yarn. Looms have been considerably improved within the past few years, and many refinements have been necessitated to insure the successful weaving of artificial silk yarns. In a new installation at a spinning mill in Bolton employing individual motors the motor is placed on the top of the frame and the drive is by means of an endless rope to a rope pulley on a tin roller shaft. The rope is taken up by a gallows pulley. In this particular instance 50 motors are being installed. — *Electrician* (*England*), Feb. 25, 1927.

Induction Motors with Friction Clutch.—K. OBERMOSER.—During the last 20 years a great many contrivances have been patented and built embodying the idea of an induction motor equipped with a loose pulley, where by means of a centrifugally operated mechanism a clutch is made gradually to grip the pulley as the motor gains in speed. Apparently none of these contrivances has stood the test of time, and European rules forbid the use of induction motors with squirrel-cage armatures of more than about 1½ hp. output on account of the voltage fluctuations during the starting period. The author gives a general history of this development and describes finally a new and seemingly successful attempt to solve the problem. A simplified friction coupling is recommended. Its action depends upon a star-delta starting switch, taking advantage of the brief drop in speed when switching over from star to delta. It is claimed that motors with squirrel-cage armatures equipped with such a coupling and starting switch are no longer restricted to small capacities, because their starting current is well within the prescribed limits.—*Elektrotechnische Zeitschrift*, Feb. 13 and 20, 1927.

Electrophysics, Electrochemistry and Batteries

Thermionic Properties of the Rare-Earth Elements.—E. E. SCHUMACHER and J. E. HARRIS.—Data are presented in this paper which indicate that rare-earth metals of the cerium and yttrium groups are without exception much more active thermionically than the commonly occurring metals. The electron emission from some of these rare-earth metals was found to be a million times as great as that from clean tungsten at the same temperature. Two methods for the determination of thermionic activities of materials obtainable in powered form are described in this paper. — *Bulletin Reprint B-226, Bell Telephone Laboratories*, January, 1927.



THERMIONIC ACTIVITY MEASUREMENTS, BOAT METHOD

Traction

Automatic Reversing Bow Collector.—For handling passenger trailers in the yard and shop the Toronto Transportation Commission uses a small locomotive which is called a "shifter" or "shunter." This railway operates 258 trailers in its passenger train service, and it has been found most economical to use a special car, since the movements are short and reversing is very frequent. An automatic reversing trolley was found desirable so that the locomotive could be operated by one man. As a result the car is equipped with a bow collector of quite novel contruction and quite different from the usual form of pantograph. When the car is reversed the direction of the bow collector automatically changes without breaking contact or without attention from the operator. In changing from one position to another the supporting mechanism, which is ordinarily held in operating position by springs, is caused to depress against the spring action and thus provides space which permits the bow collector to reverse and still keep uniform contact against the wire.—*Electric Railway Journal*, March 5, 1927.

Rapid Transit in Large Cities.—CHARLES KERR, JR.—Since the average surface car can hardly average better than 8 to 10 miles per hour and residential districts now lie at some distance from business centers, surface transportation fails to solve the problem of rapid conveyance of individuals throughout the extent of large cities. Two solutions lie in main-line suburban service and rapid-transit systems. The former, according to the author, can handle only a very limited number of people so that the real solution of the problem lies in rapid-transit lines supplemented by surface lines. Detailed discussion is made of several systems of rapid transit now in existence in American cities. A description of cars used is given, and traction motors and types of control employed, schedules and safety features are dealt with, together with a general consideration of distribution systems and costs.—*Electric Journal*, March, 1927.

Miscellaneous

Electric Shocks from Motorized Office Machines.—K. HEINRICH.—Complaints that electric shocks had been received from cash registers, adding machines, multigraphs, and other motor-driven contrivances used in modern offices were recently investigated. In every case the motor was an alternating-current one operated from a grounded neutral supply and its internal insulation was found to be perfect. To avoid noisy operation such machines are almost invariably installed on a felt cushion or on tables with rubber wheels and are therefore well insulated from ground. Touching a metallic part of the machines will therefore carry capacitative current through the person to ground. Grounding is a positive guard against this, but it is not always convenient with portable machines. It is recommended to provide a metallic stand for the operator and to connect this stand with the metal parts of the machine.—*Elektrotechnische Zeitschrift*, Jan. 20, 1927.

Aluminum Alloy of High Rupturing Strength.—E. DUSAUGEY.—In an attempt to develop an aluminum alloy from which wires and cables of exceptionally high mechanical strength could be drawn, without impairing appreciably the electric conductivity of pure aluminum, a new alloy has recently been found, containing 98.5 per cent Al and 1.2 per cent Mg and Si. Wires drawn from these alloy ingots receive a special hardening and heat-treatment process, which gives them up to 50 per cent greater strength than copper. The accompanying tabulation gives the characteristics of the new alloy in comparison with copper and pure aluminum. The new alloy, which has been named "almelec," makes cables which are stronger and lighter than an electrically equivalent steel-aluminum cable. Since small wires made of alloy are at least as strong as copper wires, it is now possible to use light-weight "almelec" wires for telephone and telegraph lines.—*Revue Générale de l'Electricité*, Feb. 19, 1927.

News of the Industry

Coal Strike Begins

Two Hundred Thousand Miners in Central Bituminous Field Cease Production on April 1

A STRIKE of 200,000 soft-coal miners in the central competitive field of Illinois, Indiana, Ohio and western Pennsylvania on Friday, April 1, was reported certain on Thursday as the ELECTRICAL WORLD closed its forms. Temporary agreements signed in the outlying districts based on a continuance of the so-called Jacksonville scale until a new agreement acceptable to both sides can be negotiated seemed sure, however, to prevent a nation-wide cessation of work in the bituminous fields. It had been hoped in many quarters that proposals from the United Mine Workers that a similar arrangement be accepted in the central field would minimize the disturbance even in those regions, but the president of the Illinois Operators' Association declared after a meeting that while his association was ready to confer with the union at any time, no progress could be made if the miners insisted on continuing "the ruinous Jacksonville scale."

Operators predicted a virtual 100 per cent shutdown, while the miners insisted that a sizable tonnage in the outlying fields would be represented by those pits that would remain in operation at the present scale pending negotiations for a basic agreement. The brunt of the strike will fall on western Pennsylvania.

CENTRAL STATIONS WELL STOCKED

Officials of central-station companies burning coal from the mines affected report an abundant supply ahead. Moreover, according to a bulletin issued by the Coal Bureau of the Chamber of Commerce of the United States, the potential productive capacity of the non-union bituminous coal mines is more than sufficient to meet normal demands. The chamber's report says that "the best estimates available give the potential capacity of non-union mines at approximately 10,000,000 tons per week. Against this weekly productive capacity, the average weekly consumption of bituminous coal for the six months' period beginning April 1, based upon average weekly figures for the past five years, will be approximately 9,250,000 tons." Reserve stocks of coal on hand April 1, the report shows, are abnormally high. It is estimated that the reserve supply as of that date between 70,000,000 and 75,000,000 tons, a total higher than any previous figure. "To the estimated stocks on April 1," the report says, "should be added coal in transit, usually estimated at two weeks' production—probably between 20,000,000 and 25,000,000 tons—which gives a probable total reserve on April 1 of between 90,000,000 and 100,000,000 tons."

Regardless of how long-drawn-out or how disastrous to the operators and the miners involved the strike may prove, it seems reasonably certain, therefore, that no shortage of coal will be caused and that there will be small, if any, price increase over the country as a whole.

Coming Institute Meetings

Program Ready for Regional Gathering at Bethlehem, Pa., and Under Way for Pittsfield

TECHNICAL papers to be presented on Thursday, April 21, at the Middle Eastern regional meeting of the American Institute of Electrical Engineers at the Hotel Bethlehem, Bethlehem, Pa., have been scheduled as follows: "Oil Circuit Breaker Development," R. M. Spurck, General Electric Company; "Reducing Losses in Electric Systems," J. B. Moorhouse, Central Illinois Public Service Company; "Improvement in Large Induction Motors," D. F. Alexander, Westinghouse Electric & Manufacturing Company; "Intercommunication in Industrial Plants," L. A. Cutshall, Automatic Electric Corporation, and "The Mercury-Arc Rectifer," O. K. Marti and Harold Winograd, American Brown Boveri Electric Corporation. In the evening there will be an informal dinner, with an address by M. H. Aylesworth, president National Broadcasting Company.

On Friday "Application of Electricity in Cement Mills" will be discussed by W. E. North, Coplay Cement Manufacturing Company; "Application of Electric Power to Anthracite Mining" by E. B. Wagner, Lehigh Valley Coal Company; "Recent Developments in Electric Drive for Rolling Mills" by L. A. Umansky, General Electric Company; "Lightning and Its Effects on Transmission Lines" by J. H. Cox, Westinghouse Electric & Manufacturing Company, and B. G. Jamieson, Commonwealth Edison Company, will present the committee report on voltage standardization.

Vice-president A. G. Pierce of the Institute will speak briefly in opening the sessions, and on Friday evening at the Alumni Memorial Building, Lehigh University, where Thursday afternoon's sessions also will be held, Dr. Ernest J. Berg of Union College, Schenectady, will recount reminiscences of Heaviside and Steinmetz. Saturday will be devoted to plant inspection trips in the Bethlehem district.

A regional meeting for the Northeastern District, A. I. E. E., will be held at Pittsfield, Mass., on May 25-27. Among subjects likely to be discussed are accuracy in high-frequency measurements, mechanical forces in electrical circuits and tap-changing transformers. It is planned to hold a students' convention in connection with this meeting.

Boulder Dam Committee

Secretary Work Appoints Four Well-Known Men to Investigate—Attitude of Utah and Arizona

BEFORE sailing for Honolulu from San Francisco on March 30, Secretary of the Interior Work named four members of a commission to make a survey of the Boulder Dam project. These appointees are United States Senator Charles W. Waterman of Colorado, William F. Durand, professor emeritus of Stanford University; James R. Garfield, former Secretary of the Interior, and James G. Scrugham, former Governor of Nevada. Secretary Work has asked the committee to meet him at Yuma, Ariz., April 29, where the first meeting will be held. The committee will make a survey of the lower Colorado River, inspect Boulder Canyon and other dam sites and report its findings after investigation of the Colorado River situation to the next Congress in December.

Representative Don B. Colton of Utah has come out with a statement to the effect that Utah can no longer stand in the way of Boulder Dam legislation by Congress. In his opinion the next Congress will enact legislation providing for the construction of Boulder Dam and the all-American canal, and any reasonable guarantee that the states within the Colorado River drainage area desire will be included. Regarding Arizona's demand for an annual payment to her of $6 per horsepower of hydro-electric energy developed, Representative Colton said such a tax would enable that state to remit all taxes. He said a fee of $1 would be more reasonable.

Canadian Parliament Likely to Kill Canal-Power Bill

After many weeks of debate in the Canadian House of Commons, the Montreal, Ottawa & Georgian Bay Canal bill, involving a fight over power rights in Carillon, on the Ottawa River, which raised an issue of jurisdiction between the Dominion and the Provinces of Ontario and Quebec and aroused much animosity, was on March 28 referred to the railways and canals committee, where it is likely to be killed. No private bill of recent years has created so much discussion. On eight occasions it was talked out in the House, and four whole days were occupied in discussing it.

Premier King took part in the final debate. He said there was nothing particularly exceptional in renewing a charter which had already been passed twelve times before. Even if the company wanted to construct a power plant, there was nothing wrong with that. He assured the House, however, that there had been no commitment of any kind by the government with

regard to the measure. Every member of the government side of the House was free to vote as he liked.

It was the opinion of W. D. Euler, Minister of National Revenue, that the bill would be killed by the railways and canals committee and that the company's charter would be at an end. "I would regard it as almost unthinkable that the control of the Carillon power should be placed in private hands," he said. In the course of the debate R. B. Bennett, former Minister of Finance and a director of the International Paper Company, contended that if the bill were passed in its present form it would hand over to the canal promoters not only the site at Carillon, but 200 miles of water on the Ottawa River, upon which were situated power sites capable of developing one million horsepower.

Electrical Men Aid New England Council

Edgar Discusses Growth of Interconnection and Offers Help in Solving Rural Service and Industrial Development Problems—M. J. Insull and Samuel Ferguson Speak

ELECTRICAL problems of regional interest occupied the center of the stage at Boston on Friday, March 25, when meetings of the New England Council and the Engineering Division of the N.E.L.A., New England Section, were addressed by President Charles L. Edgar of the Edison Electric Illuminating Company of Boston, upon "Power Development in the Northeast." At the Council meeting, which was attended by representatives of many leading industries and businesses, Governor Fuller of Massachusetts emphasized the importance of cheap power in regional competition with other sections of the country and declared his opposition to federal regulation of interstate power transmission. Martin J. Insull, president Middle West Utilities Company, called attention to the economic handicap of the non-exportation of power policy so long in force in Maine and pleaded for the free interchange of energy between states. At the N.E.L.A. meeting nearly 400 members and guests also heard an address by Samuel Ferguson, president Hartford Electric Light Company, on the economic benefits of the Connecticut Valley power exchange.

At the close of his address Mr. Edgar, in response to a need voiced in the Council proceedings of the day, announced his own support and the aid of utility companies in general in New England, so far as this could be offered without formal vote, to a co-operative program embracing the study of both rural service economics and industrial development. Prompt consideration will be given to both matters, and a conference on farm service will be held at an early date.

Mr. Edgar's address took the form largely of an analogy worked out between railroad, highway and transmission-line building and interconnection. A much-condensed abstract of some of his points follows:

MR. EDGAR'S OUTLOOK

"Last year our committee was requested by the New England Council to make a study of the power situation in New England, and, if possible, to answer the following questions: First—What has been the development in New England of the interconnection idea? Second—Has this development, as well as general central-station development, been carried forward as rapidly as in other parts of the United States? Third—What can the committee say as to the future policy of New England companies along the broad question of interconnection and general development of the industry?

"We have had prepared a large map of New England showing the various interconnecting lines which have been built during the past few years. [Copies of this map were distributed at the meeting. It will be reproduced in an early issue of the ELECTRICAL WORLD.] Some of these lines have been built for many years, but the development has been much more rapid during the past three or four years than during the dozen years preceding. In the map of the United States which you also see, covering interconnections up to the year 1923, I have separated New England from the rest of the country so you can compare the relative density of lines. With the exception of Maine, the density in the New England States is at least equal to that in the leading Eastern states like New York, New Jersey and Pennsylvania—perhaps not quite as dense as in the territory around Chicago. New England has an investment in the central-station business somewhat larger relative to its population than exists in the entire United States. The increase in investment in 1926 is considerably less relatively than the total investment or the population. This is because New England is more thoroughly saturated electrically than the United States as an entirety. The output, exclusive of railroads and street railway companies, is somewhat greater proportionally than the whole of the United States, and if railroads and railways are taken into consideration, it is somewhat less than in the country as a whole. The proportion of kilowatt-hours manufactured in New England by water power and by steam power is exactly the same as it is for the entire United States. If my conclusions are correct, therefore, you will see that New England is holding its own in its electric development as to interconnections, investment, kilowatt-hours and water-power development.

"For the same reason that interconnection among the railroads has enabled the products of one district to be easily transported to another and thus to be of advantage to both districts, the construction of these interconnecting power lines is enabling water powers, on the one hand, and steam powers, on the other, to work hand in hand. Until very recently steam powers could not get the advantage of cheap water power for their base load, neither could water powers get the advantage of steam connections for reliability. This development, therefore, has marked a new era in combining the advantages of steam and water power into one enterprise.

"The electric power companies and electric interconnections are going through exactly the same process as the steam roads went through when they were in process of building. Interconnection is just as inevitable in electric circuits as it is in the transportation world. The various steps by which this will be brought about are just as unknown as they were in the railroad world a quarter or a half century ago. All that we can say is that they are bound to come if experience in other lines is to teach us anything."

A.S.T.M. Committees Meet at Philadelphia

The regular spring group meeting of the committees of the American Society for Testing Materials was held in Philadelphia from March 15 to 18 inclusive, 25 committees taking part. Among these were those on magnetic properties, magnetic analysis, copper wire and electrical insulating materials, all of which showed progress in research. In addition, meetings were held of the joint research committee of the A.S.T.M. and the A.S.M.E. on the effect of temperature on the properties of metals. The meetings were attended by about 425 members and guests, representing the industries concerned and representatives of the railroads, electrical industries, public utilities and the federal government.

Governor Pinchot Addresses Wisconsin Legislature

Although Wisconsin papers printed from advance copy a speech purporting to have been made before a joint session of the Wisconsin Legislature on March 24 by former Governor Pinchot of Pennsylvania and containing his familiar arguments on electricity and its control, as a matter of fact only a small part of this speech was actually delivered. Governor Pinchot spoke on electric service for only five minutes and then turned his attention to the conservation of forests, fish and game, in which he said he had learned that Wisconsin is more interested. Mr. Pinchot, in fact, declared that "Wisconsin had been most forehanded in protecting its water-power resources" and that he was not referring to that state when he said that "the electric power monopoly has a stranglehold on regulation" and that two things must be done to remedy the existing condition—"one to prevent the payment of interest on money that was never put into the business, the second to compel companies to figure bills on the cost of service."

Some Wisconsin utility men are of the opinion that the Governor has been the victim of misinformation and that, if he is open to conviction, a proper presentation of the case of the electric light and power industry might cause a reversal of his attitude on the whole question of power supply.

Texas Again to the Fore

Current Year Will See 500 Miles Added to Transmission Systems Already 4,500 Miles in Length

ELECTRIC power development in Texas promises to make even greater strides during the present year than it made in 1926. This is indicated by the recent announcement of power companies of plans for constructing extensions of wooden-pole transmission lines aggregating more than 500 miles, which will add approximately 75 communities to the list of towns supplied with light and power. Expansion last year was not confined to any one company or any particular part of the state. New transmission lines radiate in every direction.

The Texas Power & Light Company is, as previously reported, negotiating for the purchase of the dam across the Colorado River at Austin. If this transaction is consummated, the company agrees to expend a million dollars in rehabilitating the dam and hydro-electric plant. This company was very active last year in acquiring electric light and power plants and in the construction of extensions of its transmission system. During the year it constructed or acquired nearly 350 miles of high-voltage lines, not including distribution lines built in a number of towns and cities. It also put into operation the new Trinidad power plant in Henderson County, thus adding 50,000 kw. to the power supply of the state. This plant, which burns powdered Texas lignite, mined 8 miles from the plant, is designed for an ultimate capacity of 160,000 kw.

Another addition to the power supply available in Texas was made last fall when the New Braunfels plant of the Comal Power Company, subsidiary of the San Antonio Public Service Company, was started with a capacity of approximately 30,000 kw. This plant also burns powdered lignite and is tied into the transmission system covering the greater portion of the state.

The Dallas Power & Light Company is installing an additional 25,000-kw. unit. Several smaller power plants have been constructed at strategic points in the last few months. A 60,000-volt line is being constructed between Houston and Bellville in south Texas, while another line from Fort Worth to Mineral Wells will be completed within a short time. Announcement has been made that another 100-mile link in the interconenected transmission system of Texas—one between Wichita Falls and Breckenridge—will be completed in the summer.

Generating capacity of the Central Power & Light Company's main plant, which serves the lower Rio Grande Valley, has been increased from 4,000 hp. two years ago to 12,000 hp., and when equipment now being placed in the La Paloma station near San Benito is completed about June 1, the total rating will be 22,000 hp. This company, with headquarters at San Antonio, serves 120 towns in south Texas, including the lower Rio Grande Valley, the rice belt, Gulf Coast, Winter Garden and the Guadalupe districts. During 1926 177 miles of transmission lines were built.

The electric power companies of Texas have a total of 4,500 miles of high-voltage lines, serving more than 350 towns and cities in an area covering the greater portion of the state. Thirty-three generating stations are conected to this power system and have a combined capacity of approximately 320,000 hp.

Accounting Section of Northwest Association Meets

Stores and purchasing, credit rating, statistics, customers' records and merchandise sales accounting were discussed at length by delegates to the general meeting of the Accounting Section, Northwest Electric Light and Power Association, held at Portland on March 21. This was the second annual meeting of the section. It was called by the section chairman, W. L. Fitzpatrick, general auditor Mountain States Power Company, Tacoma, who presided. Progress reports were heard from some of the committees, and the subjects brought up for discussion were such as to assist in completing the committee reports for the year.

Purchasing and storeroom accounting was discussed by I. D. Murfield, Portland Electric Power Company, and B. E. Lee, Mountain States Power Company, Albany, Ore.; stock and stock keeping by M. D. Field, California-Oregon Power Company, Medford, Ore.; statistical methods by D. F. McCurrach, Northwestern Electric Company, Portland, and H. L. Walther, Oregon Public Utility Information Bureau; credit information by F. L. Nagel, Portland Gas & Coke Company; internal auditing by R. H. Jones, Utah Power & Light Company, and M. J. Wilkinson, Pacific Power & Light Company; customer billing and accounting by Chairman Fitzpatrick and by W. F. Miller of the Washington Water Power Company, and appliance-sales accounting by O. V. Johnson, Mountain States Power Company, Tacoma. Others joined in the general discussions following the presentation of papers or reports.

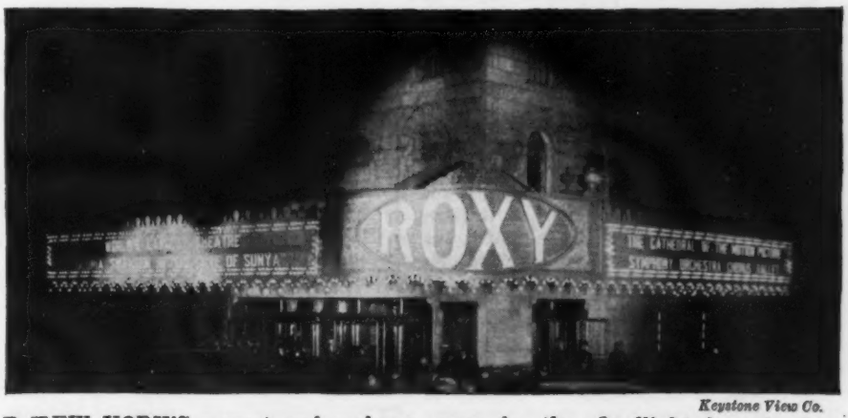
President of Great Northern Talks on Electrification

The ten-million-dollar tunnel in the Cascade Mountains in Washington is being carried forward with all possible speed, said President Ralph Budd of the Great Northern Railroad recently, and indications are that it will be completed before the end of next year. With its completion approximately 100 miles of the Great Northern road will be electrified.

The Washington Water Power Company has taken over and is developing the Chelan River power project with a view to eventual electrification of the Great Northern east of Wenatchee and through northern Idaho, Mr. Budd explained. Full development of this power, it is estimated, will cost $10,000,000. It is not the intention to proceed with electrification east of Wenatchee for some time, Mr. Budd said, and the power units that are being constructed at this time, therefore, are provided primarily so that the large amount of potential power at Chelan may be put to useful purposes. The arrangement with the Washington Water Power Company, while safeguarding future needs of the Great Northern road for electrification purposes, provides for making power available for public use, making possible the irrigation of several thousand acres of land now idle. The Chelan power project is unrelated to the electrification of the line between Wenatchee and Everett. Power for that part of the line will be supplied by Stone & Webster from hydro-electric plants on the west side of the Cascade Mountains.

In connection with this electrification the Great Northern already has in service two new electric locomotives of the motor-generator type built by the Baldwin Locomotive Works and the Westinghouse Electric & Manufacturing Company. They are the most powerful of their kind, each of them weighing 715,000 lb. and having a tractive force of 88,500 lb.

Exterior Illumination of Roxy's New Theater



Keystone View Co.

NEW YORK'S newest and perhaps largest motion-picture house, the Roxy Theater, is shown here as it appears from the street when ready for the evening performance, its exterior illumination rendering it conspicuous even in the floodlighted and sign-occupied section where it is situated. The opening of this amusement place a week or two ago attracted immense crowds to its corner at Fiftieth Street and Seventh Avenue.

In the Legislative Mill

Tri-State Delaware River Treaty Waiting on New Jersey—Minnesota Considers State Water-Power Bill

A COMMITTEE of New Jersey senators and assemblymen has conferred at Harrisburg, Pa., with members of the Pennsylvania Legislature on proposed changes in the pending tri-state water treaty, with which are involved possible hydro-electric projects on the Delaware River. New Jersey desires that the guaranteed minimum flow of the Delaware River be increased. As the New York Legislature, which approved the treaty, has adjourned, any amendments approved by New Jersey and Pennsylvania would delay operation of the treaty. Representatives of the city of Trenton insist that the treaty needs revision from beginning to end. Twelve Senate votes, enough to defeat it, were pledged against the treaty in its original form.

The Texas Legislature, which has ended its session, passed a law authorizing electric companies to supply light and power at points distant from their headquarters.

In Oklahoma the Lower House has passed the Ebey bill requiring a 60 per cent majority of tax-paying electors voting in an election to sell municipally owned utilities. The bill has been reported favorably in the Senate and awaits action.

Under a proposed amendment to a bill in the Minnesota Senate the state would have the power to acquire and develop any or all water powers and operate such plants as are needed and to supply electricity for state institutions or sell to municipalities and private consumers. The amendment would allow the Legislature to vote bonds or provide for certificates of indebtedness to carry on this work, provided the aggregate amount outstanding at one time should never exceed $50,000,000. A bill providing for placing water-power matters under the supervision of the Railroad and Warehouse Commission was indefinitely postponed by the general legislation committee of the House.

In spite of the abandonment in the Nebraska House of the combination irrigation and power project to serve 43 southern and southeastern counties, and the substitution of a power project only, the Senate utilities committee has recommended the original bill for passage, with amendments aimed to meet objections of farmer members. Farmers and municipal plants would have preference in the sale of energy by the Senate bill. The new House bill authorizes the incorporation of hydro-electric districts within the state, the initial step being the filing with the district court of a petition containing the signatures of at least 25 per cent of the electors within the district.

A bill passed at the recent session of the Indiana Legislature and signed by the Governor empowers the owners of real estate in any block fronting a city street to have, by petition, street-improvement plans include structures necessary for a street-lighting system and to have the costs apportioned with the other costs. If preferred, the petitioners may have lighting standards that also carry trolley wires and force the removal of trolley poles.

Governor Adams of Colorado has approved a law providing that in "home rule" cities no public utility shall be acquired until the plan of acquisition has been approved by the voters, unless otherwise provided in the city charter. "Such ordinance," it is enacted, "shall describe the property to be acquired, the full purchase price to be paid by such city or town therefor and the method of payment thereof, as well as the total obligations to be incurred by such city or town in making such acquisition, whether by way of general obligation bonds of such city or town, issued under the provisions of the constitution, or by way of obligations chargeable solely or in part against the income of such utility. In event of the issuance of obligations payable solely out of income, all operating and other costs shall be met solely out of income of the utility acquired."

Under the terms of the Garrison bill, one of a series which public ownership advocates have introduced in the California Legislature, public utility companies would be forced to apply for permission to the State Railroad Commission before they might expend any money for or against any ballot proposition. They would be forced to name in advance the sum they wished to expend and should they go over this amount they would be liable to a fine of twice the amount of money expended.

The constitutional amendments committee of the California Assembly has before it, as previously mentioned in this column, an amendment to limit the rights of use of all waters of the state to a beneficial and reasonable use and to prevent wasteful use of water. This amendment is designed to correct the situation set up by the recent court decision in the suit of the Herringhaus estate against the Southern California Edison Company. An advocate of the amendment says:

"Under this amendment we are not taking away from any man anything that he can use. We say that whether he be riparian owner or appropriator he can have all the water he can use. But we do say that what he cannot use he cannot hold up the people of the State of California and charge them for it. If the power companies pay the Herminghaus people $5,000,000 for those water rights, the people must pay the bill."

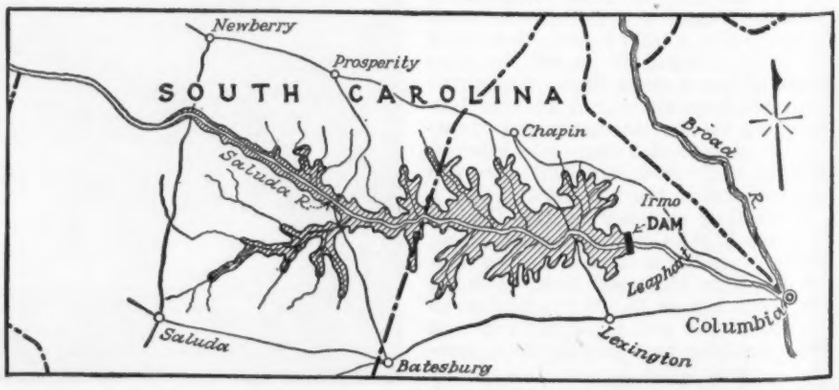
Southeastern Division Gets Ready for Memphis

The Southeastern Division of the National Electric Light Association will hold its annual convention at the Hotel Peabody, Memphis, on April 13-15 inclusive. About 400 delegates are expected to attend. Following an address of welcome on Wednesday morning by Mayor Rowlett Paine and a response by P. S. Arkwright, B. C. Edgar, president of the Southeastern Division; R. F. Pack, president of the N.E.L.A.; Paul S. Clapp, managing director of the N.E.L.A., and Earl Whitehorne, commercial editor of the ELECTRICAL WORLD, will speak.

Speakers on Thursday morning will be J. F. Gilchrist, vice-president Commonwealth Edison Company, who will discuss "Electric Appliances as Aids to the Industry"; G. E. Durban, Delco Light Company, who will talk on electric refrigeration; Dr. E. A. White, who will tell about progress in rural electrification, and Dr. H. A. Morgan, president of the University of Tennessee, whose subject is to be "Industrial Progress Through Decentralization." Friday's speakers will include W. A. Jones of New York, chairman Public Relations Section, N.E.L.A.; W. S. Vivian, Midwest Utilities Company, Chicago; Gen. Harvey H. Hannah, of the Tennessee Railroad and Public Utilities Commission; Miss Isabelle Davie, secretary of the women's committee, N.E.L.A., and Lovick P. Miles, editor of the *Commercial Appeal*, who will speak on "What the Public Expects of the Electric Light and Power Industry."

Group meetings will be held by the four sections of the association Wednesday evening at 8 o'clock and Thursday and Friday afternoons at 2 o'clock.

South Carolina's Coming Big Hydro Plant



THE above map, prepared by engineers of the Lexington Water Power Company, gives a bird's-eye view of the coming hydro-electric development on the Saluda River, showing the dam and the lake, with relation to Columbia and other nearby places. This development, which is to exceed Muscle Shoals and Conowingo as regards the actual length and height of the dam, was described in the ELECTRICAL WORLD for March 5, page 516.

Progress in Rural Service Continues

Indiana, Nebraska, Wisconsin, Texas, Georgia and New York Among the States from Which Encouraging Reports of Increasing Electrification Come

GENERAL and specific reports indicate that fairly rapid progress is being made in many widely separated sections of the country in extending electric service to farmers.

In Indiana no little interest attends the demonstration of electric farm equipment on the electric traction car fitted out by the Purdue University agricultural extension department in co-operation with Indiana electric companies and interurban lines. The car is to make a tour over all the electric railways of Indiana, and farmers will have an opportunity to inspect it en route. Trueman E. Hienton of the agricultural engineering staff is in charge of the car, which is equipped with a model farm kitchen. Appliances on board include milking machines, cream separators, poultry-house lighting systems, ensilage cutter, feed grinder, incubator, fanning mill, water-supply system, cider press, wood saw, churn and grindstone.

NEBRASKA, WISCONSIN, MICHIGAN

The Nebraska Gas & Electric Company is taking an advanced position in regard to bringing electrical energy to the farms in the territory where its lines run. Beginning with 1927, the company is bearing $250 of the expense of building a distribution and service line to each rural customer, on condition that the farmer will purchase $250 worth of equipment. This may be purchased from the company or from any dealer in electrical devices, but does not include the cost of wiring and fixtures. The plans is unique in Nebraska, but a similar one has been in successful operation for a year or more in Wisconsin.

Experience proves that where four connections can be made to the mile the cost will run around $250 each, but when fewer customers per mile are connected the cost per customer increases. It is the purpose of the company to put the rural customer on as nearly the same basis as possible with the city customer, and it is estimated that the company will within a short period under this plan connect up about 200 farms at a total cost to the company of about $50,000. There will be a delivery charge of $3.50 a month per customer for a 1½-kva. transformer. This will be the minimum bill. To it will be added an energy charge as follows: First 25 kw.-hr. used per month, 8 cents per kilowatt-hour; next 25, 6 cents; excess kilowatt-hours, 4 cents. Under this schedule the farmer who uses 50 kw.-hr. a month will pay $7; if he uses 100 kw.-hr. a month, he will pay $9, and on using 200 kw.-hr. a month, as would be likely in the use of refrigeration and cooking, the cost would reach $13.

Added impetus to the extensive farm electrification movement in Wisconsin was provided when the Wisconsin Railroad Commission accepted the new rural rate schedule submitted by the Wisconsin Public Service Corporation, which will result in a 20 per cent reduction in rates for electric service furnished farms in its territory. Under the new schedule the farmer is permitted to use up to 10 kw.-hr. per month for a minimum bill of $2 net, instead of there being a service charge of $1.50 per month plus payment for the amount of energy consumed. The company will also contribute to the cost of a farm extension a sum equal to the estimated revenue from the line in the first three years, the customer thus obtaining his electric service as a portion of the cost of his line, which he has three years to meet. G. C. Neff, chairman of the National Committee on the Relation of Electricity to Agriculture, reports that 50 per cent of the farms in the southern half of Wisconsin will be equipped for electric service during the next five years and that already twice as many farms in that state have been electrified as in the Province of Ontario under the public ownership plan prevailing there.

Installation of adequate wiring facilities is essential for success in rural electrification, Prof. H. J. Gallagher, project leader of the Mason-Dansville experimental electric line, told members of the Michigan Grange at Ann Arbor recently. "One of the main reasons why many farmers of the state who already have electricity are not making the greatest use of the service is the fact that their buildings are not wired for service other than lights and small household appliances," he said. "In thinking of electricity, the farmer thinks of it for lighting and operating small household appliances, and wires accordingly. Then as he becomes more familiar with the possibilities of using energy for productive work he finds that to change his service and then buy equipment is somewhat expensive. The best time to wire for future use is when the wiring is first installed."

TEXAS AND GEORGIA

Electric power has now been brought within reach of three-fourths of the farms of Texas, according to a survey made by local power companies. In the lower Rio Grande Valley, where remarkable agricultural development has taken place during the last few years, power transmission lines extend to every community. The same is true of the upper irrigated district of the Rio Grande in the vicinity of El Paso. Engineers of the State Agricultural and Mechanical College, co-operating with the committees on electricity and agriculture of the Southwestern Public Service Association and National Electric Light Association, have for two years been making a study of rural electric service. W. B. Head of the Texas Power & Light Company reports that his company has more than 550 miles of farm transmission lines and that much effort is being made both by his company and by others to extend this service. "The number of rural customers served by the Texas Power & Light Company," Mr. Head says, "increased from 2,172 in 1921 to 7,096 in 1926, a gain for the five-year period of 300 per cent."

Finding as the result of an agricultural and industrial survey that half the farmers of Georgia desired to diversify their cotton crops with other products, and seeing in such diversification a greater field for the use of electricity on the farms, the Georgia Utilities Information Bureau, under the lead of its secretary and vice-director, Willard Cope, undertook to help the Georgia Association raise funds to promote this plan and, where necessary, make loans to farmers to help them make the change. The committee organized and carried through a campaign which involved communication with every editor, banker, farmer, schoolteacher, preacher, mayor and county official in the state; supplying to every newspaper material to advertise a "cow-hog-hen" week, and holding meetings in 125 out of 161 counties. As a result of the campaign between five and ten thousand farmers are expected in a year or two to adopt livestock raising in place of exclusive cotton growing, with a resultant impetus to electrification. Light and power organizations, headed by the Georgia Power Company, subscribed liberally to the campaign fund.

NEW YORK STATE

According to Herman Russell, vice-president and general manager of the Rochester Gas & Electric Corporation, some of the most efficient rural electric installations to be found anywhere are in the counties adjacent to Rochester. In Monroe County there is a total length of improved roads amounting to 419 miles, and domestic electric service is supplied to 68 per cent of this mileage. Similar service is being developed rapidly along improved highways in adjacent counties. Reduction in rates on electricity in rural districts in upstate New York will it is thought, accelerate the installation of electric service in farms along the power lines or wherever they can be reached by building extensions of moderate cost. Among companies to make reductions in rates are the Western New York Utilities Company, supplying Batavia, Albion and many other places, and the New York Central Electric Company, which has lowered its charges in Dansville and other places near Horning.

In territory around Syracuse rural electrification has made great progress in the last two or three years, largely owing to the policy of the Syracuse Lighting Company in extending its lines to villages and farms. There are 413 square miles in the area in which the company holds franchises, exclusive of the city of Syracuse and the villages of Solvay and East Syracuse. In this total area the company has 318 miles of lines and supplies 1,400 farms with electric service, while 5,410 farms to which service from existing lines is available are not using it. The total number of farms in the rural franchise area is 16,870, and it contains 5,800 miles of highway.

Purchases and Mergers

Foshay Sells People's Light & Power Corporation—National Public Service and U.G.I.—Wide Activity

ANNOUNCEMENT is made by W. B. Foshay, president of the W. B. Foshay Company, that he and his associates have contracted to sell their holdings in the People's Light & Power Corporation to G. L. Ohrstrom & Company, New York. The rumored price is about $3,000,000. The People's Light & Power was organized last year by the Foshay interests to merge thirteen electric, gas, water and street-railway properties in Vermont, Wisconsin, Minnesota, Iowa, Arizona, Washington and Oregon, nine of these being electric light and power companies, namely, People's West Coast Hydro-Electric Corporation, Oregon; Willapa Power Company and Ilwaco Light & Power Company, Washington; People's Arizona Gas & Electric Corporation, People's Minnesota Gas & Electric Corporation, People's Wisconsin Hydro-Electric Corporation, Municipal Power Corporation, Wisconsin Hydro-Electric Company and People's Hydro-Electric Vermont Corporation. To these holdings two Idaho companies were subsequently added, being consolidated with the People's West Coast concern. In making the announcement of sale Mr. Foshay said that his company was beginning the formation of a new group of public utility properties in Arizona, Kansas, Idaho and Utah.

A substantial minority interest in the National Public Service Corporation, the large holding company acquired two or three weeks ago from the A. E. Fitkin interests by Day & Zimmermann, has been transferred by the latter firm to the United Gas Improvement Company. Emphatic denial is, however, made by Day & Zimmermann of newspaper rumors that the U.G.I. has acquired or will acquire control of the National Public Service Corporation.

ACQUISITIONS BY PITTSBURGH COMPANY

Negotiations for the purchase of the municipal plant at Coraopolis, Pa., and the United Electric Light Company at Wilmerding, Pa., have been completed by the Standard Gas & Electric Company. Both of these plants, which are within the so-called Pittsburgh district, will be operated by the Duquesne Light Company and later will be merged into and made a part of that company's system. Sale of the Coraopolis municipal plant will prove particularly advantageous to residents and taxpayers in that it will bring a reduction in the domestic rate of about 25 per cent. The United Electric Light Company recently completed a station containing two 2,500-kva. turbo-generators. This plant will continue in operation for the time being, but will probably be closed down eventually and energy supplied by the Duquesne company.

The Pennsylvania Edison Company of Easton desires to absorb the Riegelsville Light & Power Company of Bucks County, Pa.; the Boyertown Electric Company wants the Bechtelsville Light & Power Company of Berks County; the Metropolitan Edison Company of Reading seeks to absorb eight rural light companies in Lebanon, York, Cumberland and Adams Counties, and the Northern Pennsylvania Power Company seven in Wayne and Tioga Counties. These applications, in which in nearly every instance the smaller companies have been incorporated to protect the franchises of the parent concerns, will be heard by the Public Service Commission on April 14. Eleven other applications from the Metropolitan Edison are reported, the companies operating in Dauphin, Berks, Montgomery, Lehigh, Lebanon, Adams and Chester Counties.

The New York Public Service Commission has granted the petition of the Wynantskill Hydro-Electric Company of Rensselaer County for permission to transfer its franchises, works and system in the towns of Sandlake and North Greenbush to the Harlem Valley Electric Corporation.

For the Farmville (Va.) Power & Electric Company's municipal plant the Virginia Public Service Company has offered $305,000 cash. The offer will be submitted to the taxpayers. A legal battle over power rights in Hopewell, Va., has been ended by the purchase of the Prince George Electric Light & Power Company holdings there by the Virginia Electric & Power Company. The amount involved was reported to have been approximately $200,000.

Acquisition of the properties of the Chickasha (Okla.) Gas & Electric Company by the Southwestern Light & Power Company has been announced. Both are Insull subsidiaries. Seventy communities in Oklahoma are now served by the Southwestern Light & Power Company system as a result of the acquisition, twenty of which are in the Chickasha territory.

The Nebraska Electric Power Company has purchased the plant at Arapahoe, which supplies that town and the nearby village of Edison. The property will be managed from the headquarters of the Western Public Service Company at Scottsbluff.

By a majority of six to one, Monroe (Neb.) voters have authorized the sale of their light and power plant and distribution system to the Northwestern Public Service Company.

The Dakota Public Service Company has submitted an offer to take over the Mount Vernon (S. D.) municipal light plant and system. The proposal will probably be voted on April 19. A special election will be held in Alexandria, S. D., May 3 to decide the question of selling the municipal plant to the Northern States Power Company.

Sale of the Limon (Col.) municipal electric light plant to the Commonwealth Utilities Corporation, Denver, will be submitted to the voters on April 5. A special election in the early part of April will likewise be held in Otis, Col., on the proposed sale of the light plant there to the same concern, which has recently purchased the Akron (Col.) plant. The Commonwealth Utilities Corporation is controlled by the Troy-Graham Company of Chicago, which also controls the Colorado Utilities Corporation, now serving Craig, Hayden, Oak Creek and Steamboat Springs, Col.

On April 19 Fort Collins, Col., will vote on an amendment to the city charter to make possible the acquisition and operation of public utility properties by the city. This municipality is now being served by the Public Service Company of Colorado.

As stated in more detail under "Financial and Statistical," the Porto Rico Railways Company is now controlled by the International Power Company of Canada. The Porto Rico Railway, Light & Power Company of San Juan is a subsidiary of the Porto Rico Railways Company.

The International General Electric Company announces that it has acquired interests in three Latin-American public utilities through one of its foreign subsidiaries. The properties are the Companhia Brazileira de Energia Electrica, which supplies electricity to Nichteroy, a town across the bay from Rio de Janeiro, and the Companhia Linha Circular de Carros da Bahia and the Companhia Trilhos Centraes, which operate transit and power and light systems in the city and State of Bahia.

Briefer News

Yosemite Power Company Gets State Permit for Tuolumne Plant.—The California Division of Water Rights has announced the issuance of a permit to the Yosemite Power Company of San Francisco for the right to use waters of the Tuolumne River at Heardin, for which it applied last year. Expenditure of $5,500,000 on the plant is contemplated.

Chimney Rock Plant in North Carolina Goes Into Commission.—The first water from the Lake Lure plant at Chimney Rock, N. C., several notes concerning which have been printed in former issues, went over the 104-ft. dam on March 21, and officials say that the plant will be put into operation immediately. The power will be used by the Blue Ridge Power Company. The reservoir began filling on Sept. 26. The lake covers 1,200 acres and has a shore line of 27 miles. The dam is 574 ft. across.

Raquette River, New York, as a Source of Power.—In presenting the first annual report of the Northeastern Power Corporation, its president, H. E. Machold, said that four mechanical water-power plants on the lower Raquette River in the Adirondack district of New York State were being converted to hydro-electric plants of 15,000-hp. capacity and that work had been started on a plant at South Colton, on the Raquette River, with an initial capacity of 13,000 hp. and an ultimate rating of 39,000 hp. All of this coming power, Mr. Machold said, had been sold under long-term contracts.

First Arc Lamp Installed on the Banks of the Wabash 47 Years Ago.—On March 31, 47 years ago, in the city of Wabash, Ind., the official test of the first arc lamp installed for a municipality, was held. This new means of illumination had been tried some time before in stores and offices but never, it is asserted, for street-lighting purposes, and the

popular astonishment and enthusiasm were great. One of the four lamps used in this early demonstration is now in the possession of R. W. Klare, district manager of the Northern Indiana Power Company. It is to be placed in a suitable setting on the lawn of the court house at Wabash as a monument to the epochal event of which it is a relic.

Recent Transmission-Line Extensions in North Carolina Have Cost $1,000,000.—Early completion of a 30,000-volt transmission-line extension in northeastern North Carolina, serving the principal communities on Albemarle Sound, has been announced by the Virginia Electric & Power Company. The distribution substation for this line is in Winfall, whence also radiate the recently completed lines to Hertford and Edenton. The remaining section will run to Elizabeth City, connecting at Suffolk with the Virginia trunk line. Including the new Tarboro-Scotland Neck line and a circuit being built from Lasker to Winton, this power-extension program in North Carolina represents an investment of more than $1,000,000.

Oswego's Water-Power Rights Leased for 25 Years.—Contracts were signed on March 25 between the Water Service Commission of Oswego, N. Y., and the Oswego River Power Corporation for the development and leasing of the city's power rights at Dam 6 in the Oswego River for a period of 25 years at an annual rental of $50,000, the plant to be built by the power company and turned back to the city at the end of that period. The Oswego River Power Corporation was the only bidder, and the lease follows a special election in February sanctioning the plan (ELECTRICAL WORLD, Feb. 19, page 418). The new plant will develop 7,500 hp., and the estimated cost is $850,000. Work will start immediately.

North Dakota Board Claims Authority Over Plant Transfers.—Sales of electric distribution or other public utility property in North Dakota are void unless authority to make the transfer has first been obtained from the North Dakota Board of Railroad Commissioners. This declaration was made by the board recently when residents of Ashley protested against the proposed sale of the Ashley electric plant by the Otter Tail Power Company to the Northern Power & Light Company of Mobridge, S. D. The result of the ruling, members of the board declare, is to challenge the title to public utility properties sold without authorization. It also opens to question securities issued against such properties.

Carlisle Offers to Buy Surplus Power of Watertown, N. Y.—Before a mass meeting of 2,000 residents of Watertown, N. Y., Floyd L. Carlisle offered last week on behalf of the Northern New York Utilities, Inc., to buy the surplus electric power generated at the city's plant under a contract to be drawn by Owen D. Young of the General Electric Company or any other competent electrical authority, at a price which would involve neither profit nor loss to the corporation. A bill to permit the city to dispose of this power independently of the company failed to get through the last Legislature. It has now been agreed that A. L. Mullergren of Kansas City, consulting engineer for Watertown, shall have access to the company's books to ascertain a fair price, after which discussion of the contract will be resumed.

Kansas to Be Host to Middle West N.E.L.A.—For the first time in the state's history Kansas will be host to the electric light and power industry of other states when the fifth annual convention of the Middle West Division, N.E.L.A., meets at Topeka on May 18, 19 and 20. The division comprises Iowa, Missouri, Nebraska and Kansas. Program arrangements are proceeding, and announcement is made that R. F. Pack, national president, and other notable men of the industry will speak. The Commercial Section will occupy a place of major importance, and S. D. Heed, president of the Electric Household Utilities Corporation, will deal with organized sales effort. The annual meeting of the Kansas Section, N.E.L.A., will not be held in connection with the Middle West Division convention, but is scheduled to take place in Salina, probably in October.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD for Jan. 1, page 80.]

Southeastern Division, N.E.L.A.—Peabody Hotel, Memphis, Tenn., April 13-15. C. M. Kilian, 404 Wynn-Claughton Bldg., Atlanta.

American Institute of Electrical Engineers—Middle Eastern District, Bethlehem, Pa., April 21-23; Northeast District, Pittsfield, Mass., May 25-27; summer convention, Detroit, June 20-24. F. L. Hutchinson, 36 West 39th St., New York.

Southeastern Water and Light Association—Jackson, Miss., April 26-28. W. F. Steiglitz, Columbia, S. C.

Southwestern Division, N.E.L.A.—New Orleans, April 26-29. S. J. Ballinger, San Antonio Public Service Company, San Antonio, Tex.

Southwestern Public Service Association—New Orleans, April 26-29. E. N. Willis, 403 Slaughter Bldg., Dallas, Tex.

Nebraska Section, N.E.L.A.—Grand Island, Neb., April 27-28. H. M. Davis, 1519 O St., Lincoln.

American Electrochemical Society—Benjamin Franklin Hotel, Philadelphia, April 28-30. Colin G. Fink, Columbia University, New York.

Electrical Supply Jobbers' Association—Greenbrier Hotel, White Sulphur Springs, W. Va., May 4-6. Franklin Overbagh, 411 South Clinton Street, Chicago.

Missouri Association of Public Utilities—Cape Girardeau, May 5-7. F. D. Beardslee, 315 North 12th St., St. Louis.

Middle West Division, N.E.L.A.—Topeka, Kan., May 18-20. H. M. Davis, 1519 O St., Lincoln, Neb.

American Society of Mechanical Engineers—White Sulphur Springs, W. Va., May 23-26. C. W. Rice, 29 West 39th St., New York.

Canadian Electrical Association—Clifton Hotel, Niagara Falls, Ont., May 25-27. J. B. Woodyatt, Southern Canada Power Company, Montreal.

American Association of Engineers—Tulsa, Okla., June 6-8. M. E. McIver, 63 East Adams St., Chicago.

National Electric Light Association—Atlantic City, N. J., June 6-10. Paul S. Clapp, 29 West 39th St., New York.

National Electrical Manufacturers' Association—The Homestead, Hot Springs, Va., June 13-18. S. N. Clarkson, 30 East 42d St., New York.

Pacific Coast Electrical Association—Santa Cruz, Cal., June 14-18. S. H. Taylor, 447 Sutter St., San Francisco.

North Central Division, N.E.L.A.—Lake Superior steamboats from Duluth, June 17-20. J. W. Lapham, 351 Loeb Arcade, Minneapolis.

Northwest Electric Light and Power Association—Salt Lake City, June 21-24. C. W. Lundquist, Utah Power & Light Co., Salt Lake City.

Rate Cutting and Competition in Nebraska.—Attorney-General Spillman of Nebraska has brought an action against the Interstate Power Company and a number of its subsidiaries in which he alleges that they, together with the Northern Nebraska Power Company of Spencer, now constructing a hydro-electric plant on the Niobrara River, from which the Interstate has contracted to purchase all energy produced, have violated a state law which prohibits varying rates in different towns to destroy competition. At Hartington, where the Tri-State plant was sold to the Interstate and where the Council subsequently gave a franchise to the Hartington Electric Light Company, a subsidiary of the Western States, the state charges that the Interstate organized the Cedar Light & Power Company and cut rates below cost of service in order to eliminate competition.

International Issue Involved in Maine-New Brunswick Power Site.—The Province of New Brunswick is taking a lively interest in the Fish River storage bill, now before the Maine Legislature, which involves International Paper Company interests and is being opposed by the Maine & New Brunswick Electrical Power Company of Presque Island, Me. Premier Baxter of the Canadian province, expressing his conviction that this bill, which would permit water storage of great value to the full development of the Grand Falls project in New Brunswick, will be passed as an act of international comity, declared that its defeat would not add a kilowatt of energy to Maine's total and took credit to the province for permitting exportation of Aroostook Falls power that might, he said, have found a market east of the boundary had its exportation been prohibited.

An Unusual Power and Light Election.—By a vote of 526 to 305 taxpayers of Miles City, Mont., last month approved the principle of selling the municipal light and heating plants. The election was wholly financed by companies competing for the purchase of the utilities. These were the Montana Power Company and the Minnesota Northern Power Company. It followed an intensive educational campaign of about three weeks in which the companies even defrayed the expense of Carl D. Thompson of Chicago, a municipal ownership advocate, who was in

charge of the city's side of the compaign. The vote was taken merely to get the genuine sentiment of the taxpayers, and the city administration is not absolutely bound by its result; the assumption is that the Council will call for bids for the property, go through the formality of making the sale to the most satisfactory bidder and then refer the agreement to another vote.

New Unit Planned for Pasadena.—Specifications for a new 15,000-kw. steam unit to be added to the present plant of the Pasadena municipal light department are about to be prepared. Several months ago Benjamin F. De Lanty, manager of the department, urged the necessity of constructing a new unit to bring the total plant capacity to 28,000 kw., and it is desirable, according to him, to have the unit in operation in time to help care for the peak load in 1928. This unit will cost approximately $612,000.

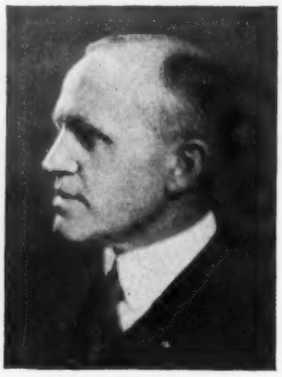
Power Conference at University of Iowa.—A conference to consider resources, generation, transmission and utilization of power in Iowa was held on March 30 and 31 at the University of Iowa, Iowa City, with the co-operation of the College of Applied Science and the extension division. Many aspects of the subject were dealt with, among those on the program being President Jessup, Deans Williams, Packer, Jones, Phillips and Kay, Professors Nagler, Ford, Fleming and Olin and Director Lauer of the university; Dwight Lewis, chairman Iowa Railway Commission; C. S. Macy, president Iowa Section, N. E. L. A.; Joe Carmichael, director Iowa Committee on Public Utility Information; H. R. Summerhayes of the General Electric Company, and F. J. Hanlon, W. C. Tegtmeier, G. T. Shoemaker, John A. Reed, R. H. Garrison, Don M. Sterns, E. F. Buhlman and H. C. Orton, representing various Iowa central-station companies.

Fifteen Millions to Be Appropriated for Ontario Hydro.—Estimates submitted to the Ontario Legislature on March 23 include appropriations totaling $14,970,000 for extensions to the provincial hydro-electric power system. The Niagara system is to have $9,395,000 spent on it. This includes increased transformer capacity in Thorold, Welland, London, Preston, Stratford, St. Marys, St. Thomas, Brant, Guelph, Hamilton and Toronto, costing $1,500,000, and construction of transmission and distribution lines costing $7,225,000, the principal items being $5,000,000 for the 220-kv. line to eastern Ontario and $1,600,000 for the erection of 110-kv. lines, including an extension from St. Thomas to Brant. The Thunder Bay system is to receive $4,045,000, of which $3,875,000 is for work incidental to the Alexander Landing development, now under construction. The sum of $800,000 is alloted to the superstructure and generating equipment there and $3,000,000 is provided for the substructure, canal and dam. The appropriation for primary and secondary transmission lines is $750,000, an increase of $250,000 over last year's estimate.

Men of the Industry

F. B. Hofft Heads Penn Public System

Fred B. Hofft, vice-president of the Penn Public System, in charge of its "Northwest Region," becomes the operating head of the entire system on April 15. Since 1923 Mr. Hofft has been a vice-president of this company, which is a part of the Associated Gas & Electric Company. After graduating



F. B. HOFFT

from the School of Electrical Engineering of Purdue University in 1902, Mr. Hofft became affiliated with the Merchants' Heat & Light Company of Indianapolis. He was appointed general manager in 1907 and retained this office until 1909, when he went to Monmouth, Ill., as manager of the Monmouth Public Service Corporation.

In 1912 he moved to Erie, Pa., to become manager of the Erie Lighting Company, the Olean Electric Light & Power Company and the Bradford Electric Company. He was appointed vice-president of the Erie Lighting Company in 1914 and was made a vice-president of the Penn Public System in 1923 when the Erie Lighting Company became a part of that system. When the Associated Gas & Electric Company acquired control of the Penn Public System in 1925, Mr. Hofft retained the position of vice-president in charge of its "Northwest Region." He has been prominent in the civic activities of Erie and at present is serving his second year as president of the Chamber of Commerce of that city.

Executive Changes at Providence

Important executive changes in the Narragansett Electric Lighting Company, Providence, R. I., were voted at a directors' meeting on Tuesday of this week as a result of the recent acquisition of control of the company by the New England Power Association interests. Luke C. Bradley, president of the Rhode Island Public Service Company, was elected president of the Narragansett company, succeeding Edwin A. Barrows, who has been elected vice-president. William C. Bell, general manager of the Virginia Electric & Power Company, Richmond, Va., was elected general manager of the Narragansett company, succeeding Arthur B. Lisle, who has been elected vice-president. Franklin P. Jackson, Jr., has been made secretary and treasurer, succeeding Franklin L. Hall, resigned, and J. W. Gale has been appointed assistant secretary, succeeding Jesse E. Gray, who has been transferred to the New England Power Company at Worcester, Mass. Leslie F. Mowry will continue as assistant treasurer.

Vice-president Barrows will report to the president and have direct charge of relations between the Narragansett company and the New England Power Association. Vice-president Lisle will have jurisdiction over the treasurer's office and taxation matters, also assisting the president in public relations work and reporting to him. General Manager Bell will be in executive charge of all the operating departments of the company, assisting the president in public relations and reporting directly to him. L. H. Blount will continue as auditor, and Mr. Gale will be assistant to the president as well as to the general manager and secretary of the company.

C. H. Howell Heads New Jersey Association

C. H. Howell, who was elected president of the New Jersey Electric Association just organized, has been identified with the electrical industry in that state since the spring of 1923, when he became general manager of the Atlantic City Electric Company. For eleven years prior to his affiliation with the American Gas & Electric Company

C. H. HOWELL

in Atlantic City he was connected in an executive capacity with that organization's properties in Ohio.

Following graduation from Richmond (Va.) College in 1905, Mr. Howell spent a few years as apprentice and commercial engineer for the General Electric Company, simultaneously taking a post-graduate course in thermodynamics and electrical engineering at the Massachusetts Institute of Technology. In 1912 he became manager

of the Coshocton (Ohio) Light & Heating Company, and later when other properties in the same section of Ohio were merged into what is now known as the Ohio Service Company Mr. Howell was made manager. A subsequent promotion made him vice-president and general manager, which post he occupied until his transfer to New Jersey.

Mr. Howell brings to the presidency of the New Jersey association an intimate knowledge of electrical conditions not only in the East but also in the Middle West, having had in addition to his executive duties with the utility company in Ohio those of president of the Ohio Electric Light Association.

C. L. Chamblin New Head of Electragists

Clyde H. Chamblin, who was elected president of the Association of Electragists International, as announced in the March 26 issue of the ELECTRICAL WORLD, has been a prominent figure in the electrical industry on the Pacific Coast for many years. A native Californian, Mr. Chamblin in 1912 entered the employ of the company of which he is now president, the California Electrical Construction Company of San Francisco, as superintendent and estimator and in the following year together with T. H. McDonnell acquired all the stock of the company. Since 1916 Mr. Chamblin has been sole owner of his company.

Mr. Chamblin is at the present time president of the California Electragists and was at one time president of the old California State Association of Electrical Contractors and Dealers. He has been a member of the advisory board of the California Electrical Bureau for a number of years. He was a recipiont of an award of honorable mention at the first presentation of the

C. L. CHAMBLIN

McGraw award. Mr. Chamblin has been a member for a number of years of the board of directors of the Society for Electrical Development, and he was the contractor member of the executive committee of the N.E.L.A. in 1923.

J. M. Armstrong, formerly general superintendent of the Mutual Light & Water Company, Brunswick, Ga., has been appointed manager to succeed O. C. Lisman, resigned. Mr. Lisman was manager of the Brunswick properties for more than seven years. Mr. Armstrong's services with the company began 25 years ago.

D. R. Street has been appointed general manager of the Ottawa (Canada) Light, Heat & Power Company, Limited, to succeed the late A. A. Dion.

A. S. Grenier New Vice-President of Electric Bond & Share

Arthur S. Grenier, who was recently elected a vice-president of the Electric Bond & Share Company and also of the Electric Bond & Share Securities Corporation, as announced in the March 19 issue of the ELECTRICAL WORLD, has been with the Electric Bond & Share Company since 1912. He entered the public utility business in the mechanical and electrical departments of the Sioux City Traction Company in 1894. Subsequent connections included the South Chicago Street Railway Company, the Calumet Electric Railway Company of Chicago, the North Chicago Street Railway Company (Yerkes System) and the Gilman Electric Light & Power Company.

From 1902 to 1905 Mr. Grenier was identified with public utility properties at Keokuk, Iowa. In the latter year he removed his interests to Chicago as an employee of the financial house of Trowbridge & Niver, where he engaged in supervising the operations of public utilities and irrigation. In 1910 he became vice-president and general manager of the Pacific Power & Light Company and the Walla Walla Valley Railway, Portland, Ore.

In addition to being a vice-president of the Electric Bond & Share Company and Electric Bond & Share Securities Corporation, Mr. Grenier is a vice-president of the Electric Power & Light Corporation, president of the Southwestern Power & Light Company, and vice-president of the American Power & Light Company, Texas Power & Light Company, Fort Worth Power & Light Company, Houston Lighting & Power Company, Dallas Power & Light Company, Nebraska Power Company, Pacific Power & Light Company, Portland Gas & Coke Company and Kansas Gas & Electric Company.

W. S. Hovey Becomes the Chief Executive of Fairbanks-Morse

W. S. Hovey was elected president of Fairbanks, Morse & Company March 29, succeeding C. H. Morse, who becomes chairman of the board. Mr. Hovey, who is a graduate of Cornell, entered the service of the Sheffield Car Company, an affiliate of Fairbanks, Morse & Company, in 1902 as assistant superintendent. He later became superintendent, which position he held until 1913, when he became manager of the engine division of the Beloit works of Fairbanks, Morse & Company. Later he was made manager of that plant. He was made vice-president of Fairbanks, Morse & Company in 1919, at which time he assumed charge of all of the manufacturing activities of the company.

Sporn Made Electrical Engineer of A.G.&E. Company

Philip Sporn, who has been affiliated with the American Gas & Electric Company since 1920, has been appointed electrical engineer in charge of electrical design and construction for that utility. Mr. Sporn received his education at Columbia University, where he also took post-graduate work. After a period of service with the Crocker-Wheeler Electric Manufacturing Company, he joined the engineering department of the Consumers Power Company of Jackson, Mich., where he was

PHILIP SPORN

engaged in station design and in special technical work. In 1920 he joined the engineering department of the American Gas & Electric Company. Here, as assistant to the electrical engineer, he was associated in the extensive engineering and construction work on stations, substations, transmission lines and distribution systems and in all work involved in connection with the development of the system of the American Gas & Electric Company and its welding together into one of the largest interconnected systems in the country. During the last four years he was also in direct charge of the engineering division of the electrical engineering and construction departments.

During his stay with the American Gas & Electric Company Mr. Sporn has had charge of the carrying on of extensive investigations on relaying of interconnected systems, on transmission lines, and particularly on lightning phenomena as affecting transmission lines and on oil-circuit-breaker performance. He has contributed frequently to the technical press and has also presented several papers before the American Institute of Electrical Engineers. He is a member of that Institute and also of the Franklin Institute.

Henry M. Robinson, president of the First National Bank of Los Angeles, has been elected a member of the board of directors of the General Electric Company. Mr. Robinson is an associate in public work of Owen D. Young, chairman of the board of directors. He is also a director of the Southern California Edison Company, the Southern California Telephone Company and

other enterprises. The appointment of Mr. Robinson to the directorate is in accordance with the policy of regional representation followed by the General Electric Company in selecting its board.

C. A. Leland, Jr., formerly assistant general manager and chief engineer of the Kansas Power & Light Company, Topeka, Kan., has been appointed to succeed the late M. G. Linn as vice-president and general manager of the Des Moines Electric Light Company and the Iowa Power & Light Company.

Dr. S. Z. De Ferranti, engineer and inventor, has been recommended for election into the Royal Society of Great Britain by the president and council of the Royal Society. Dr. De Ferranti was a pioneer in the development of the electrical industry, and during his career he has made notable contributions to the progress of electrical art by his inventions. He is a past-president of the British Institution of Electrical Engineers.

C. D. Flanigen, formerly president of the Athens Railway & Electric Company, has been elected vice-president of the Georgia Power Company in charge of the Athens district. The Athens Railway & Electric Company lost its identity through merger with the Georgia Power Company. At the same meeting **Sidney Z. Mitchell,** president of the Electric Bond & Share Company, and **Thomas W. Martin,** president of the Southeastern Power & Light Company, were elected directors.

Harris E. Dexter, formerly connected with the Department of Commerce, Washington, D. C., has affiliated himself with the Central Hudson Gas & Electric System, Poughkeepsie, N. Y., in the capacity of general merchandising manager. For some years Mr. Dexter was identified with the General Electric Company and its subsidiaries in the designing and testing departments and for four years held the position of merchandise man for the General Electric Company in China.

James M. Wakeman, a prominent figure in the electrical industry for many years, sails on April 2 on board the *Baltic* for Liverpool. Mr. Wakeman will visit England, Scotland, Belgium, Austria, Germany, Switzerland, Italy and France. Some years ago Mr. Wakeman was associated with the ELECTRICAL WORLD as vice-president and general manager and later spent eight years with the Society for Electrical Development in the capacity of general manager. Mr. Wakeman will return to the United States in October.

Obituary

Benjamin L. Martin, who was identified for more than 28 years with the Georgia Railway & Power Company, Atlanta, Ga., and its predecessors, died March 5 at his residence after a brief illness. He was 65 years of age. Mr. Martin became connected with the company in 1888 and was soon placed in charge of the lamp department, a post which he held until 1904, when he was made superintendent of the line department. He remained head of the line department until 1916, when he retired.

Recent Court Decisions

Company Absolved from Liability for Death Due to "Act of God."—Holding that a severe storm in December, 1923, was "an act of God and not controlled by the Gray's Harbor Railroad & Light Company," the Supreme Court of the State of Washington has confirmed the Grays Harbor County Court in denying recovery for the death of Gustave Quarnstorm, whose heirs brought suit. Quarnstorm was found dead on a city street in contact with a live electric wire which had been torn from its fastenings by the gale.

Boy Injured by Electricity While Walking on Railroad Right-of-Way Held Trespasser.—In Sorenson vs. Chicago, Milwaukee & St. Paul Railway refusal of damages to a boy injured by a broken transmission wire while walking along the railroad right-of-way was approved by the Supreme Court of Wisconsin, which held the boy to be a trespasser notwithstanding that he and other children had habitually walked on the right-of-way in going to or coming from school and that no warning had been given them and no effort made by the railroad company to prevent the practice. (212 N.W. 273.)*

Whether Contributions of Minor Child to Mother Would Continue Is Question for Jury. — Sustaining the lower court in the amount of damages awarded, in D'Angelo vs. Rutland Railway, Light & Power Company, to a mother whose eighteen-year-old son met death because of the falling upon him of a high-voltage wire of the defendant, for which he worked, the Supreme Court of Vermont held that it was for the jury to decide whether it was probable that the sums paid would have been continued after the son had reached his majority and the mother had no longer the same legal claim upon them that she had while he was under age. (135 At. 598.)

Former Arbitration Provision Inapplicable After Commission Approves New Rates.—The Seneca Iron & Steel Company was sued by the Niagara, Lockport & Ontario Power Company because of its refusal to pay new power rates approved by the New York Public Service Commission. The State Supreme Court found for the plaintiff, pointing out the firmly established police power of the state to increase or lower public service rates regardless of existing contracts and declaring that an arbitration clause in the original contract upon which the industrial company relied was no longer applicable after the Public Service Commission's approval of a new rate schedule. (219 N.Y.S. 418.)

Child in Alley Not Owned by Company Is Not Trespasser as to Company. —Upsetting a nonsuit motion granted by the trial court in Puchlopek vs. Portsmouth Power Company on the ground that a boy killed by a transmission wire belonging to the company was a trespasser in an alley adjacent to the electric line, the Supreme Court of New Hampshire declared that since the company did not own the alley, the child was not a trespasser as to it. The wire that caused the fatality was carried along a rail running from a transformer station and was reached by the boy, who thrust his arm between pickets of a fence separating the transformer station from the alley. Whether the company should have foreseen the possibility of such an accident and guarded against it, and whether the boy was trying to tamper with the company's equipment, thereby making him a trespasser as to the company, were questions that should have been submitted to the jury, the Supreme Court said. (136 At. 259.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Oklahoma Commission Orders All Exported Electricity Measured at State Line.—The Corporation Commission of Oklahoma has notified every electric utility operating within the state which is now engaged or may hereafter become engaged in transmitting energy from or to other states to install the most recent types of outdoor metering devices at the fitting locations on the Oklahoma state line, for the purpose of accurately recording on daily charts the actual quantities in kilowatt-hours of energy imported and exported from and to other states. A hearing to consider rules and regulations affecting this matter and also the measurement of natural gas imported or exported will be held.

Reasonable Conditions Making Rural Service Obligatory.—The Pennsylvania Public Service Commission has ordered the Harmony Electric Company to extend its lines more than a mile along a highway so as to serve applicants along the route, where it appeared that the service could be furnished without imposing any unreasonable conditions on the company. In making this decision the commission said: "The respondent company stated that it would construct the line if contributions were received from the applicants sufficient to meet that portion of the cost of construction over and above an amount equal to twice the estimated annual revenue, which is the amount the company proposed to invest in this extension. Various estimates of costs of the construction were submitted. From the evidence the commission finds that the proposed line, together with 100 ft. of lateral wire for each prospective consumer, will cost approximately $4,600. The revenue to be derived from the petitioners at the rates in effect at the time of hearing is estimated to be $814. The position taken by respondent company that it will not expend on the new line a sum greater than twice the amount of estimated annual revenue is unreasonable."

Financial and Statistical

Sargent Bill Left in Committee—Bond Prices Not Affected—Heavy Trading in Utility Stocks—

PUBLIC utility bonds will not be eligible for investment by savings banks in New York State for the present. The failure of the Legislature to pass the Sargent bill before adjournment, however, has had no adverse effect upon the markets. Investment bankers did not expect any reaction to result in view of the excess of demand for first-grade utility bonds over offerings. Neither the banking interests nor utility executives are worrying at all over the matter. As a leading banker said to the ELECTRICAL WORLD this week: "Such legislation can only be postponed—it cannot be permanently side-tracked. It is bound to come up again since it is needed both by the companies and by investment institutions."

One thing about the Sargent bill that has not been made clear by press reports is that it does not propose to legalize all utility bonds, but only what might be called the cream of the issues. Certain limitations and restrictions in the bill result in weeding out all but highest-grade bonds. It eliminates all but first mortgages or the equivalent. Acceptable issues must not exceed three-fifths of the physical value of the property. There must be capital stock back of the bonds representing at least 66⅔ per cent of the value of the bonds. The company's earning record must have been satisfactory for a period of years.

Trading in utility stocks has expanded steadily. Last week's New York Stock Exchange list shows unusually heavy trading in this group, with several utilities up around the hundred-thousand-share mark for the week. American & Foreign Power, for example, had a total of 113,000; Electric Power & Light certificates, 129,200; National Power & Light, 83,300. The New York curb also showed a heavily increased volume of trading.

Common stocks have gained considerable ground during the week. Edison Electric of Boston, Metropolitan Edison, Middle West Utilities and Columbia Gas & Electric helped to boost the average. The ELECTRICAL WORLD index of fifteen common stocks rose two points during the week, to 98, against 95 at the beginning of the year and 86 this week last year. Some of the manufacturing stocks, however, have shown continued reaction. Preferred stocks have made only slight gains in a few favored issues.

Central-Station Revenue Records Again Broken

January Earnings Amount to $160,500,000—Daily Average Exceeds $5,000,000—Energy Output 6,287,576,000 Kw.-Hr.—Pronounced Activity in the South

REVENUE of the electric light and power industry for January, 1927, amounted to $160,500,000, thus exceeding the figures for December by more than $6,000,000, and those for January, 1926, by $15,000,000, according to estimates based on reports from companies operating 88 per cent of the installed central-station generating capacity in the United States. This marks a new high record, as December had established the previous maximum figure.

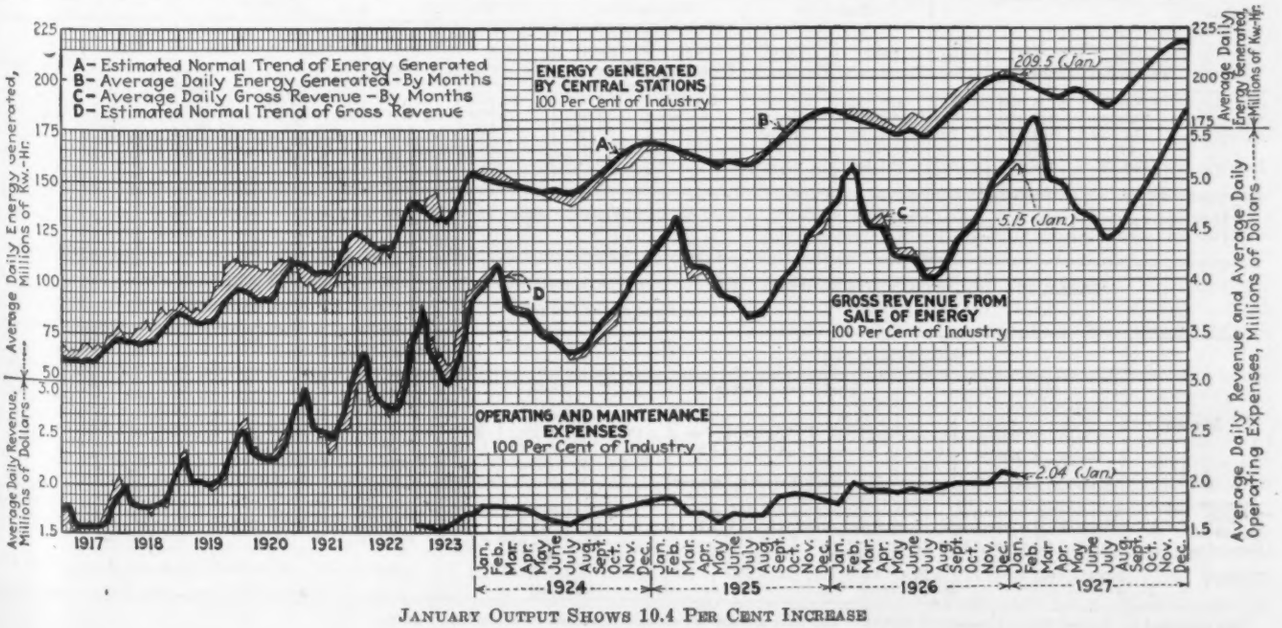
TABLE I—OPERATING RATIO OF CENTRAL-STATION COMPANIES

	Operating Ratio					
	Steam Plants		Hydro Plants		Combined Hydro and Steam Plants	
	1926	1925	1926	1925	1926	1925
Oct.	47.7	48.6	35.2	37.8	44.0	44.3
Nov.	44.5	44.3	34.5	33.5	41.9	42.8
Dec.	43.4	45.5	36.7	35.5	40.8	42.6
1927	1926	1927	1926	1927	1926	
Jan.	40.6	40.6	33.3	31.8	39.2	40.4

The returns indicate that the rate of progress which had continued through 1926 with only a moderate slowing down toward the end of the year was being substantially maintained, the annual increase for January being 10.5 per cent as against 11 per cent for November and 12.3 for December.

Operating expenses, $63,200,000, were practically the same as in December and were only 8.6 per cent above those for January, 1926. The daily average of revenue was $5,150,000 and of operating expenses $2,050,000, as shown on the accompanying chart.

The energy output, 6,287,576,000 kw.-hr., exceeded that of January, 1926, by 10.4 per cent. This is a better indicator than revenue of the continuance of activities into the new year, because it avoids the time lag between


A- Estimated Normal Trend of Energy Generated
B- Average Daily Energy Generated - By Months
C- Average Daily Gross Revenue - By Months
D- Estimated Normal Trend of Gross Revenue
ENERGY GENERATED BY CENTRAL STATIONS
100 Per Cent of Industry
GROSS REVENUE FROM SALE OF ENERGY
100 Per Cent of Industry
OPERATING AND MAINTENANCE EXPENSES
100 Per Cent of Industry
209.5 (Jan.)
5.15 (Jan.)
2.04 (Jan.)
Average Daily Energy Generated, Millions of Kw.-Hr.
Average Daily Revenue, Millions of Dollars
Average Daily Revenue and Average Daily Operating Expenses, Millions of Dollars
1917 1918 1919 1920 1921 1922 1923
1924 1925 1926 1927

JANUARY OUTPUT SHOWS 10.4 PER CENT INCREASE

TABLE II—GENERATION AND DISTRIBUTION OF CENTRAL-STATION ENERGY IN THE UNITED STATES
(100 per Cent of the Industry)

Month	Kw.-Hr. Generated Monthly *			Estimated Distribution of Energy Generated										Energy Purchased by Public Utilities for Resale, Kw.-Hr.	
				Total Energy Consumption by Central-Station Customers, Kw.-Hr.		Energy Consumed for Lighting, Kw.-Hr.		Energy Consumed for Power, Kw.-Hr.		Energy Sold to Electric Railways, Kw.-Hr.		Energy Used in Intracompany Business, Including Line Losses, Kw.-Hr.			
	1926 Thousands	1925 Thousands	Per Cent Inc.	1926 Thousands	1925 Thousands	1926 Thousands	1925 Thousands	1926 Thousands	1925 Thousands	1926 Thousands	1925 Thousands	1926 Thousands	1925 Thousands	1926 Thousands	1925 Thousands
October....	6,174,959	5,550,289	+11.2	4,981,959	4,478,289	1,262,000	1,168,000	3,149,959	2,760,289	570,000	550,000	1,193,000	1,072,000	1,240,000	955,000
November	6,063,784	5,391,857	+12.4	4,933,784	4,349,857	1,310,000	1,202,000	3,073,784	2,615,857	550,000	532,000	1,130,000	1,042,000	1,195,000	996,000
December.	6,353,977	5,714,067	+11.2	5,173,977	4,611,067	1,400,000	1,258,000	3,173,977	2,803,067	600,000	550,000	1,180,000	1,103,000	1,175,000	1,050,000
	1927	1926		1927	1926	1927	1926	1927	1926	1927	1926	1927	1926	1927	1926
January...	6,287,576	5,683,055	+10.4	5,167,576	4,586,055	1,450,000	1,260,000	3,094,576	2,771,055	623,000	555,000	1,120,000	1,097,000	1,185,000	1,010,000

*Data on "energy generated" are those collected and published by the United States Geological Survey for all public utilities minus such data as are collected on energy generated by electric railway companies, reclamation service and manufacturing plants. The data are, therefore, for the electric light and power industry only.

the consumption of energy and the receipt of payment for it.

Regionally, the trends shown in December have persisted, in general; the Northeastern, and in particular the West North Central States, report a smaller increase than the national average, whereas the Southern States, embracing the South Atlantic, East South Central and West South Central divisions, are well above the general level. The most significant gain for any single state occurred in Alabama, which reports 40 per cent more output in January, 1927, than in the corresponding month a year ago.

As to revenue, January receipts reflect December operations, in the main, and may therefore be expected to follow the December movement with regard to energy output. Thus the companies reporting in New England earned 9 per cent more than they did a year ago, those in the Atlantic States 11 per cent, in the North Central States 7.5, in the South Central 21, and in the Mountain-Pacific group 12 per cent.

Water-power output continues to forge ahead by leaps and bounds; it was 20 per cent greater in January, 1927, than a year ago. Fuel-generated energy, therefore, had to grow by only 5.4 per cent. So rapid has been the improvement in plant efficiency that this was accomplished with an increase of only 2.7 per cent in coal consumption, which fuel accounts for more than 90 per cent of the total heat units; a 2.9 per cent increase in natural gas, but with a striking decrease, amounting to 23 per cent, in consumption of oil.

Energy purchased for resale appears to have remained substantially constant for at least a quarter of a year, ranging around 1,200,000,000 kw.-hr. per month. It should be noted that this figure is more affected than any other of the quantities tabulated by changes in corporate status. Thus an interchange of energy will be reported so long as the companies involved retain their individual existence, but the same interchange disappears from the record if they are merged into a more comprehensive organization, the shifting of load then becoming an intracompany rather than an intercompany transaction.

Phenomenal Growth in Philadelphia Residence Business

By means of a definite commercial policy logically conceived and aggressively executed the Philadelphia Electric Company has increased the number of its customers more than 500 per cent during the last decade. This colossal accomplishment was predicated on a house-to-house survey made in 1915. Every property of whatever nature in the city was card-indexed with detailed information in each case as to the use, present or probable, of electric light, heat and power. These records have been kept up to date, and by studying them it becomes possible to know in what direction to look for new business, where to campaign for various classes of business desired and to forecast the amount obtainable.

With these facts before them the en-

TABLE III—CENTRAL-STATION FINANCIAL OPERATIONS FOR FOUR MONTHS IN THE UNITED STATES
(100 per Cent of the Industry)

Month	Total Gross Revenue from Sale of Energy†			Estimated Distribution of Gross Revenue								Total Operating and Maintenance Expenses‡	
				Lighting Customers		Power Customers		Electric Railways		Other Public Utilities			
	1926 Thousands	1925 Thousands	Per Cent Inc.	1926 Thousands	1925 Thousands	1926 Thousands	1925 Thousands	1926 Thousands	1925 Thousands	1926 Thousands	1925 Thousands	1926 Thousands	1925 Thousands
October....	$141,300	$126,000	+12.1	$88,400	$81,100	$38,400	$33,300	$4,600	$4,400	$9,900	$7,200	$61,700	$56,300
November.	148,000	132,800	+11.4	90,400	87,700	41,900	32,600	4,900	4,400	10,700	8,100	60,900	54,800
December..	154,300	137,300	+12.3	94,800	89,600	43,500	34,400	5,400	4,600	10,600	8,700	63,500	57,800
	1927	1926		1927	1926	1927	1926	1927	1926	1927	1926	1927	1926
January...	160,500	145,300	+10.5	101,300	92,400	42,700	38,500	5,600	5,300	10,900	9,100	63,200	58,200

†Aggregate gross revenue from actual consumers, and sales to other public utilities for resale, involving a certain amount of duplication.
‡Do not include interest, taxes, depreciation or sinking fund.

TABLE IV—OPERATIONS OF CENTRAL-STATION HYDRO AND FUEL PLANTS IN THE UNITED STATES*
(100 per Cent of the Industry)

Month	Energy Generated						Fuel Consumption								
	Hydro-Plants			Fuel Power Plants			Coal			Oil			Gas		
	1926 Thousands of Kw.-Hr.	1925 Thousands of Kw.-Hr.	Per Cent Increase	1926 Thousands of Kw.-Hr.	1925 Thousands of Kw.-Hr.	Per Cent Increase	1926 Short Tons	1925 Short Tons	Per Cent Increase	1926 Barrels	1925 Barrels	Per Cent Increase	1926 Thousands of Cubic Feet	1925 Thousands of Cubic Feet	Per Cent Increase
October.....	2,122,236	1,769,058	+19.9	4,052,623	3,781,231	+ 7.2	3,317,113	3,295,768	+0.6	879,929	811,475	+ 8.4	4,872,740	4,503,408	+ 8.2
November.....	2,193,093	1,915,694	+14.4	3,870,691	3,476,163	+11.3	3,193,212	3,062,335	+4.2	926,916	744,011	+24.5	3,975,408	4,182,000	— 4.1
December.....	2,357,328	1,946,949	+21.0	3,996,649	3,767,118	+ 6.0	3,400,179	3,350,689	+1.4	766,874	761,140	+ 0.7	3,385,611	3,671,437	— 7.8
	1927	1926		1927	1926		1927	1926		1927	1926		1927	1926	
January.....	2,330,160	1,928,775	+20.8	3,957,416	3,754,280	+ 5.4	3,362,332	3,272,761	+2.7	748,336	972,131	—23.0	3,768,249	3,661,363	+ 2.9

*As collected by United States Geological Survey. The data are for the electric light and power industry only.

gineering department has been enabled to prepare for this new business and the executive department to raise the money. At the beginning of 1916 there were 26,000 residences supplied with electricity from the company's lines, and by the first of this year this number had grown to almost 360,000. During the last six years more than 175,000 old houses were wired for electricity in Philadelphia.

Very significant also in connection with this growth of new business have been the rate reductions voluntarily made by the company. The first of the recent rate reductions was made on May 1, 1922, and amounted to $1,200,000. This was followed in 1923 and 1924 by reductions aggregating similar amounts. On March 1, 1926, a still larger reduction was made, so that the total savings to the residential users during the five years aggregated $17,000,000.

Additional Legal Investments for Savings Banks

In the March 26 issue of the ELECTRICAL WORLD there was published a list of electric light and power securities which, in the opinion of the banking department, are now legal investments for savings banks in Massachusetts. This list, issued as of Nov. 15, 1926, was corrected Feb. 1, 1927, by several additions and removals, including the following:

ADDED TO THE LIST

California-Oregon Power Company:
1st and refunding mortgage, series B 6s, 1942.
1st and refunding mortgage, series C 5½s, 1955.
Central Hudson Gas & Electric Corporation:
1st and refunding mortgage 5s, 1957.
Consumers Power Company:
1st lien and unifying mortgage, series C 5s, 1952.
1st lien and unifying mortgage, series D 5½s, 1954.
Indiana General Service Company:
1st mortgage 5s, 1948.
Lake Superior District Power Company:
1st mortgage and refunding 5s, 1956.
New Jersey Power & Light Company:
1st mortgage 5s, 1956.
Queens Borough Gas & Electric Company:
General mortgage 5s, 1952.

REMOVED FROM THE LIST

Dayton Lighting Company:
1st and refunding mortgage 5s, 1937.

Employees' Participation in Buffalo, Niagara & Eastern

Since July, 1926, when all employees of the companies associated with the Buffalo, Niagara & Eastern Power Corporation were offered the right to subscribe to units of the stock, more than 90 per cent have availed themselves of the opportunity. Each unit consists of one share of preferred stock at $25 par value and one share of common stock of no par value. In addition to receiving credit for the 25 cents a week a unit which he pays in cash, the employee is also credited with interest and other credits, making the plan of payment as well as cash cost of the stock attractive from the employee's point of view.

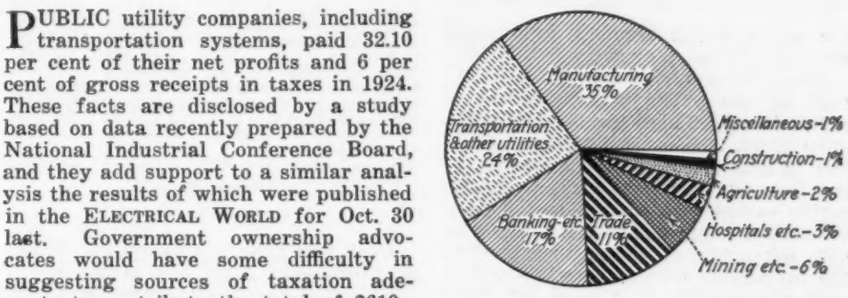
The management finds that as a result of this employee interest in the business, labor turnover is reduced, greater skill is secured on the job through longer employment and training, and company spirit is increased. The offer takes the place of the bonus plan used by many companies and enables the thrifty to accumulate a savings fund for old age without any suggestion of paternalism. During the six months of 1926 when the plan was effective 39,718 units were bought by 2,700 employees of the company, of which Paul A. Schoellkopf is president. This represents approximately one-fifth of the capital stock of the company now outstanding.

Taxes Take Almost Third of Net Revenue

Public Utility Group Contributes $611,000,000—One-Quarter of Total Taxes Received from Corporations of All Classes in the Year 1924

PUBLIC utility companies, including transportation systems, paid 32.10 per cent of their net profits and 6 per cent of gross receipts in taxes in 1924. These facts are disclosed by a study based on data recently prepared by the National Industrial Conference Board, and they add support to a similar analysis the results of which were published in the ELECTRICAL WORLD for Oct. 30 last. Government ownership advocates would have some difficulty in suggesting sources of taxation adequate to contribute the total of $610,734,000 which the public utility group paid toward the cost of government in 1924, this figure being almost one-quarter of the total paid by all corporations.

Information compiled by the United States Bureau of Internal Revenue in making an analysis of 1924 tax returns shows a continuation of the striking inequity which has existed in the incidence of taxes upon the various branches of industry. Tax returns for 1924 showed that the transportation and public utility group paid in taxes approximately six cents out of every dollar taken in. Taking percentage of net revenue as a measure, this group paid the highest proportion of any of the groups reporting net income, namely, 28.51 per cent. Of this percentage state and local taxes took almost 21 per cent, while federal income and profit taxes required 7.6 per cent.


1 2 3 4 5 6 7 Per Cent
Agriculture etc. 3.33%
Mining & quarrying 2.99%
Manufacturing 1.73%
Construction 1.11%
Transportation & other utilities 5.98%
Power & light plants (privately owned) 7.41%
Trade 0.81%
Banking, finance etc. 4.74%
Miscellaneous combinations 1.95%
1 2 3 4 5 6 7 Per Cent
Class I railroads 5.17%
Central light & power stations 6.88%
Privately owned stations 7.41%
Municipal stations 0.75%
Electric railways 6.18%
Private electric railways 6.28%
Municipal & state elec. railways 1.76%
Telephone companies 7.13%
Telegraph systems 4.54%
10 20 30 40 50 60 70 Per Cent
Class I railroads 44.9%
Central light & power stations 25.1%
Privately owned stations 26.9%
Municipal stations 3.0%
Electric railways (all) 53.1%
Private electric railways 54.6%
Municipal & state elec. railways 10.0%
Telephone companies 32.6%
Telegraph systems 22.4%

PERCENTAGE OF GROSS REVENUE PAID IN TAXES (TOP DIAGRAM) AND PROPORTION OF GROSS (MIDDLE) AND NET (BOTTOM) PAID BY VARIOUS UTILITIES

CONTRIBUTIONS MADE BY VARIOUS INDUSTRIES TO NATIONAL TAX BILL IN 1924

While the analysis referred to does not separate the railroads from other public utilities in compiling data, it is evident that the larger proportion of the burden rests on the latter. According to information provided by the Interstate Commerce Commission, taxes of steam railroads in 1924 were 5.49 per cent of gross receipts. Since this is somewhat below the above average shown for transportation and public utilities combined, the percentage for the latter group alone is evidently higher. The ratios of taxes to gross and net receipts of public utilities according to 1922 returns add some further light. The figures were as follows:

	Per Cent Taxes to Gross Revenue	Per Cent Taxes to Net Profits
Class I railroads	5.17	44.89
Central stations	6.88	25.13
Commercial	7.41	26.85
Municipal	0.75	3.04
Electric railways	6.18	53.12
Private	6.28	54.61
Municipal and state	1.76	10.03
Telephone companies	7.13	32.62
Telegraph systems	4.54	22.41

A study of the relative contributions made by privately and publicly owned utilities shows that the latter pay a negligible proportion. It is obvious that the citizen and consumer must meet this difference in some other form. As stated by the Industrial Conference Board's report, "in most cases they are lucky if they are not taxed directly for the support of such enterprises and so seduced into paying their electricity, gas or transportation bills in taxes. In the long run the service of railroads and public utilities cannot be bought for less than it is worth without paying

PERCENTAGE OF REVENUE PAID IN TAXES IN THE YEAR 1924

Corporations Reporting Net Income	Per Cent Taxes to Gross	Per Cent Taxes to Net
Agriculture and related industries	3.13	22.62
Mining and quarrying	3.63	28.41
Manufacturing	1.84	19.52
Construction	1.19	14.61
Transportation and other public utilities	6.09	28.51
Trade	.88	19.98
Public service, professional amusements, hotels, etc	2.76	22.70
Finance, banking, insurance, etc	4.91	20.75
Miscellaneous combinations	1.88	19.47

for other public services proportionately more than they are worth."

While there is little disposition on the part of the public utility leaders to complain of the high tax burden placed upon them, it is evident that the problem is one of no little importance to the industry. It has received considerable executive attention in the past, but little attempt has been made to educate the public opinion with regard to the proportion of taxes contributed in comparison with that paid by other industries.

Company Reports

Name of Company	Gross Earnings Twelve Months Ended Feb. 28 1927	1926
Adirondack Power & Light	$9,359,151	$8,457,459
Alabama Power	13,516,800	12,176,690
American Power & Light*	60,022,806	51,963,695
Associated Gas & Electric*	29,705,641	21,051,093
Bangor Hydro-Electric	1,763,491	1,607,334
Binghamton Lt., Ht. & Pwr.	1,962,560	1,727,811
Carolina Power & Light*	8,271,078	7,018,341
Central Illinois Light	4,244,172	3,930,513
Cities Service	27,521,058	20,215,041
Commonwealth Power	49,851,699	45,146,803
Consumers Power	24,501,172	21,282,227
Federal Light & Traction*	6,676,626	5,933,442
Florida Power & Light	13,329,515	10,253,472
Florida Public Service	1,729,551	1,185,819
General Gas & Electric	24,583,646	21,275,462
Illinois Power	2,594,248	2,527,275
Kansas City Power & Light	11,018,875	10,354,336
Metropolitan Edison	9,718,211	8,844,491
New Jersey Power & Light	2,487,884	1,566,524
North Carolina Pub. Serv.	2,166,885	1,873,802
Northern Ohio Power	12,034,975	11,676,657
Ohio Edison	1,835,339	1,613,775
Penn Ohio Edison	12,948,064	11,421,941
Portland Electric Power	11,891,001	11,127,988
Southern California Edison*	28,188,831	25,100,811
Southern Indiana Gas & El.	2,924,767	2,695,940
Tennessee Electric Power	11,942,760	11,718,616
West Penn Electric*	34,745,360	31,678,350
Western United Gas & El.*	6,796,804	6,088,660

* Twelve months ended Jan. 31.

Utah Company to Change Par Value of Stock.—On April 5 a stockholders' meeting of the Utah Power & Light Company will be held to amend the by-laws to permit changes in the capital structure. The contemplated changes include the conversion of present shares of stock of fixed par value into stocks having no par value. Under this plan the stock heretofore known as a 7 per cent stock, yielding at par value a dividend of $7 per year, will hereafter be known as a seven-dollar stock, yielding $7 per annum, but having no fixed par value. All stock will be classed as no-par stock. Holders of present stock will retain all the rights and privileges they held under the old designations and will not be required to send in their old stock in exchange for new.

Rumors of New Control for Lowell Electric Light Corporation.—Directors of the Lowell (Mass.) Electric Light Corporation stated in a letter to stockholders that a proposition may be made in the near future for the purchase of the entire stock of this corporation. An effort has been made to purchase some of the company's stock in the open market. "We believe it is in the interests of all stockholders to hold their stock for the present," says the letter, "until this matter takes more definite shape, and we think that by doing this they will obtain a higher cash price for

Stock Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday March 29	Low 1927	High 1927
ABITIBI PWR. & PAPER, 4% com.—no par	91½	83	93
Adirondack Pwr. & Lt.—7% pf.	106	107	109½
Adirondack Pwr. & Lt.—8% pf.	111	112	114
Ala. Pwr., 7% pf.	110½	107	112½
Allis-Chalmers Mfg., 7% pf.	£120½	120	122
Allis-Chalmers Mfg., 6% com.	96	88	97½
Aluminum Co. of Amer., com.	67	69½	73
Aluminum Co. of Amer., 6% pf.	102½	101½	103
Amer. & Foreign Pwr., pf. 25% pd.	m110	....	....
Amer. & Foreign Pwr., 7% pf.—no par	94½	86½	94½
Amer. & Foreign Pwr., com.—no par.	25½	18½	25½
Amer. Bosch Magneto, com.—no par	15½	13	18½
Amer. Brown Boveri Elec†	25½	24½	39½
Amer. Brown Boveri Elec., pf. $7	90	88½	98
Amer. Gas & Elec., 6% pf.—no par	99	95½	99½
Amer. Gas & Elec., com.†—no par	73½	68½	100½
Amer. Lt. & Trac., 6% pf.	114	112	120
Amer. Lt. & Trac., com.†	227	224½	235
Amer. Pwr. & Lt., 6% pf.	100½	97½	101½
Amer. Pwr. & Lt., com.†—no par	58½	54	61½
Amer. Pub. Serv., 7% pf.	£ 98	95	99½
Amer. Pub. Serv., com.†	50	....	....
Amer. Pub. Utilities, 7% pr. pf.	89	88	93
Amer. Pub. Utilities, 7% ptc. pf.	82	73	82
Amer. Pub. Utilities, com	m66	65	70
Amer. States Sec., A	3	3½	4½
Amer. States Sec., B	3	3	4½
Amer. Superpwr., $6 pf.—25	£ 28	26½	28½
Amer. Superpwr., 7% pf.	£ 95	....	....
Amer. Superpwr., Class A†—no par	£ 29½	27½	30
Amer. Superpwr., Class B†—no par	30½	28½	31½
Amer. Wtr. Wks. & Elec., 7% pf.	£108	104½	110½
Amer. W. W. & E., com. $1.20—20	78	62½	79½
Anaconda Copper cap. $3	47	42	49½
Appalachian Electric Pwr., 7% pf.	101	100	102
Appalachian Elec. Pwr., 2d pf., 7%	101	100	102
Appalachian Elec. Pwr., com.	m78	....	....
Arizona Pwr., 7% pf.	79	77	84½
Arizona Pwr., com.	23	....	....
Arkansas Cent. Pwr., pf.—$7 no par	k102	101	103
Arkansas Lt. & Pwr., 7% pf.	k102½	101	104
Arkansas Lt. & Pwr., com.	102½	....	....
Assoc. Gas & Elec., $3.50—50	50½	....	....
Assoc. Gas & Elec., pf.—$6—no par	88	85	90
Assoc. G. & E., Class A, $2.50—no par	40½	35	41½
BABCOCK & WILCOX, 7% com.	118	....	....
Binghamton L., H. & P., $6 pf.	92	93	95
Birmingham Elec., pf.—$7—no par	107	105	109
Blackstone Valley G. & E., $6 pf.	102½	103	105
Blackstone Valley Gas & Elec., 10% com.—50	100	98	101
Blaw-Knox, com.†	£ 72	....	....
Brazilian Trac., Lt. & pwr., com.†	f127½	....	....
Broad River Pwr., 7% pf.	100½	97	100
Brooklyn Edison, 8% com.	157	148½	159½
Buffalo, Niagara & East. Pwr., pf.—25	24½	....	....
Buffalo, Niagara & East. Pwr. com.†—no par	£ 27½	....	....
CALIFORNIA ELEC. GENERATING, 6% pf.	97	96	98
California Ry. & Pwr., 7% pf.	130	125	150
Carolina Pwr. & Lt., pf.—$7—no par	f107½	107	108½
Central & S.W. Util., 7% pf.—no par	a 95½	....	....
Central & S. W. Util., pr. in. $7 pf.—no par	a100	98½	101½
Central Ariz. Lt. & Pwr., 7% pf.	l100	100	100
Central Ark. Ry. & Lt., 7% pf.	99	100	102
Central Ill. Pub. Serv., 6% pf.	a 91½	....	....
Central Ind. Pwr., 7% pf.	88	86	90
Central Pwr. & Lt., 7% pf.	102	100½	103
Central States Elec., 7% pf.	93	93	96
Central States Elec., com.†	m200	....	....
Century Elec., 6% com.	m115	115	115
Chicago Fuse Mfg., com.—$2.50 no par	a 33½	30	34½
Cincinnati Gas & Elec., 5% com.	a 95½	....	....
Cities Service, 6% pf.	l 90½	88½	92½
Cities Service, pf. B—10	l 8	8	8½
Cities Service, pf. BB—100	l 82	82	85
Cities Service, com.—20	l 51½	40½	58½
Cities Service, Bks. Shrs.—10	l 25½	24	29½
Clarion River Pwr., 8% pf.	95	....	....
Cleveland Elec. Illg., 6% pf.	108	108	109½
Cleveland Elec. Illg., 10% com.	300	302	310
Colorado Pwr., 7% pf.	£ 95	95	97½
Columbia Gas & Elec., 6% pf.	104½	99½	105½
Columbia G. & E. com. $5—no par	86½	82½	91½
Columbia Ry., Gas & Elec., 6% pf.	94½	....	....
Columbus Elec. & Pwr., 2d. pf.	103	....	....
Columbus Elec. & Pwr., 9% com.	66½	....	....
Columbus Ry., Pwr. & Lt., 6%, 1st pf.	99	98½	99½
Columbus Ry., Pwr. & Lt., 6½% pf. B	99	96	99
Columbus Ry., P. & L., com.—no par	70	75	79
Commonwealth Edison, 8% com.	a144	....	....
Commonwealth Pwr., 6% pf.	96½	91½	97
Commonw'th Pwr., $2, com.—no par	45½	42½	48
Conn. Lt. & Pwr., 8% pf.	120	119	123
Conn. Lt. & Pwr., 7% pf.	113	112	113½
Cons. Gas of N. Y., pf.†—50	56	55½	62½
Cons. Gas of N. Y., com $5—no par.	97½	94	109½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf.	m105	105	107
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf.	e112	111	112½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 7% pf.	e114	112½	115½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 8% pf.	e127½	126	129
Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $2.50—no par	e 54½	....	....
Consolidated Pwr. & Lt., 7% pf.	100	100	103
Consumers Pwr., 6% pf.	101½	100	102
Consumers Pwr., 6.6% pf.	103	103	105½
Continental Gas & Elec., 7% ptc. pf.	104	103	106½
Continental Gas & Elec., 7% pr. pf.	£101½	100	103
Conti. G. & E. com. $4.40—no par.	k225	210	225
Crocker Wheeler, com.†	30	26	37½
Crocker Wheeler, 7% pf.	80	....	....
DALLAS PWR. & LT., 7% pf.	109	107	109½
Dayton Pwr. & Lt., 6% pf.	102	101	103
Detroit Edison, 8% com.	137	133½	140½
Dubilier Condenser, com.—no par.	k 5	3½	5½
Dubuque Elec., 6% pf.	105¾	93	105½
Duquesne Lt., 7% pf.	£115½	114½	116½
EASTERN NEW YORK UTIL., $7 pf.	103	102	104½
Eastern New York Util. com.	65	70	75
Eastern States Pwr., $7, com.	11	11	13
Eastern States Pwr., pf.	92	93	95
East. Tex. Elec., 7% pf.	106	106	108
East. Tex. Elec., com. $5—no par.	90	....	....
Edison Elec. of Boston, 12% com.	d254	....	....
El Paso Elec., com. $5—no par.	70	....	....
El Paso Elec., 7% pf.	106	105	107½
Elec. Bond & Share, 6% pf.	£106½	105½	109
Elec. Bd. & Sh. Sec., com. $1—no par	£ 69	67½	72½
Electric Household Util.†	a 12½	....	....
Elec. Investors, 6% pf.—no par.	93	92	94
Elec. Investors, com.†—no par.	35½	32½	37
Elec. Investors, 10% pd. receipts	15	....	....
Elec. Pwr. & Lt., ctfs. pf.	99½	96	99½
Elec. Pwr. & Lt., ctfs., 40% pd.	£107½	103½	107½
Elec. Pwr. & Lt., ctfs., full pd.	£106½	....	....
Elec. Pwr. & Lt., ctfs., com.—no par.	19½	16½	20½
Elec. Refrig. cap.†	27½	26½	37½
Elec. Ry. Securities, com.—no par.	£ 7½	6	7½
Elec. St. Battery com. $5.25—no par	71½	68½	79½
Elmira Wtr., Lt. & R.R., 7% pf.	100½	99	101½
Emerson Elec., pf.	m105	....	....
Empire Pwr., A $6	37½	26	38½
Engr. Pub. Serv., $7 pf.—no par	100	93½	100½
Engr. Pub. Serv., com.—no par	25	21½	25
Eureka Vacuum Cleaner, com. $4—no par	71½	60½	72½
FAIRBANKS MORSE, 7% pf.	£108	107½	112
F.-M., com.—$2.60—no par.	42½	38½	42½
Federal Lt. & Trac., com.†	41½	37½	44½
Federal Lt. & Trac., 6% pf.	96½	91½	96½
Ft. Worth Pwr. & Lt., 7% pf.	l110	108	112
GALVESTON-HOUSTON ELEC. 6% pf.	71	68	72
Galveston-Houston Elec., com.	26	28	30
Gen. Elec., 8% com.	86½	81	87½
Gen. Elec., special—10	11½	11½	11½
Gen. Gas & Elec. (Del.) com., A. $1.50—no par	40½	40½	47½
Gen. G. & E. (Del.) com. B—no par.	38½	39	43½
Gen. G. & E. (Del.) pf. A. $8—no par.	113½	113½	115½
Gen. G. & E. (Del.) pf. A $7—no par.	£ 99½	100	107½
Gen G. & E. (Del.) pf. B $7	99½	96	99½
Gen. Pub. Serv., $7 pf.	£103	102	106
Gen. Pub. Serv., com.	12½	11½	14½
Ga. Lt., Pwr. & Rys., 6% pf.	85	87	92
Ga. Lt., Pwr., & Rys., com.	m 60	....	....
Ga. Ry. & Pwr., 8% pf.	£122	119	123
Ga. Ry. & Pwr., 7% pf.	108½	106	110
Ga. Ry. & Pwr., 4% pf.	m119	....	....
Ga. Ry. & Pwr., 4% com.	120	....	....
Gt. Western Pwr., 7% pf.	h102½	....	....
IDAHO PWR., 7% pf.	103	103	105
Ill. No. Utilities, 6% pf.	£ 88	88	92
Ill. Pwr. & Lt., 7% pf.	100½	99	101
Ingersoll Rand com. $8	92½	92	95½
Int. Combus. Engr., com. $2—no par	53½	43½	64
Int. Util., Class A—$3.50—no par.	34½	28	35½
Int. Utilities, Class B—no par.	4	3	5½
Interstate Pwr., pf.—$7—no par.	93	93	97
Interstate Pub. Serv., 7% pf.	99½	98	99½
Iowa Ry. & Lt., 7% pf.	98	97	99
JERSEY CENTRAL PWR. & LT., 7% pf.	98	97½	98½
Jersey Cent. Pwr. & Lt., 7% ptc. pf.	115	111	115
Jersey Cen. Pwr. & Lt., com.—no par	£ 25	....	....
Johns-Manville, com.†—no par.	68	55½	73½

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid price Saturday, March 26. lBid price Wednesday, March 30. mLatest quotations available. †Dividend rate variable.

Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday March 29	Low 1927	High 1927
KANSAS CITY PWR. & LT. pf.$7	k112¼	112	114¼
Kansas Gas & Elec., 7% pf.	i104¼	103	104
Kentucky Hydro-Elec., 7% pf.	a 94¼	94¼	97¼
Kentucky Sec.,6% pf.	86	83	87
Kentucky Sec., 5% com.	107	110	115
Kentucky Utilities, 6% pf.	95½	95	96½
Keystone Pwr. & Lt., 7% pf.	97½	96	98¼
LACLEDE GAS LT., 8% com.	182	173½	189½
Lehigh Pwr. Sec., com.—no par.	19¼	15½	19½
Long Island Ltg., 7% pf.	109	107	109
Long Island Ltg., com. $2—no par.	140	139	153
Los Angeles Gas & Elec., 6% pf.	99	98	100½
Louisville Gas & Elec., cl. A. $1.75	27¼	23½	27¼
MAN. ELEC. SUPPLY, cap. $4.25—no par	65	53½	72
Manila Elec., com.†—no par	k 45	40	46
Maytag Mfg., com. .50—no par	28½	23½	25½
Memphis P. & L., pf.—$7—no par	108½	107	109
Metropolitan Ed., pf.—$6—no par.	96½	93	97
Metropolitan Ed., pf.—$7—no par.	103½	104	108
Metropolitan Ed., com. $5—no par.	66	....	....
Middle West Utilities, 7% pf.	a110½	....	....
Middle West Util., 7% pr. lien pf.	a118¼	117½	120
Middle West Util., com. $6—no par	a111	....	....
Midland Utilities, pr. ln. 7% pf.	a102½	....	....
Midland Utilities, 7% pf. A.	a 98	96½	99½
Milwaukee Elec. Ry. & Lt., 7% pf.	k100	100	103
Milwaukee Elec. Ry. & Lt., 6% pf.	k100	98	101
Minn. Pwr. & Lt., 7% pf.	i105½	104	105
Miss. Pwr. & Lt., $8 pf.	109	106	111
Miss. River Pwr., 6% pf.	97½	94	97
Miss. River Pwr., com.	62	....	....
Mohawk Hudson Pwr., 1st pf.—$7—no par	102	100	104
Mohawk Hudson Pwr., 2d pf.—$7—no par	101	98	101½
Mohawk Hudson Pwr., com.—no par	25½	20½	27
Montana Pwr., 7% pf.	120½	118½	121
Montana Pwr., 4% com.	93½	81½	93½
Montreal Pwr., 7% com.	f 78	....	....
Mountain States Pwr., 7% pf.	100	97	101
Mountain States pwr., com.†	18	....	....
NASSAU & SUFFOLK LTG., 7% pf.	108	98	105
National Carbon, 8% pf.	a135½	130½	137½
National Elec. Pwr., A†	a 24½	....	....
National Elec. Pwr., 7% pf.	a 96	....	....
National Lt., Ht. & Pwr., com.	24	....	....
National, Light, Ht. & Pwr., 5% pf.	70	....	....
National Pwr. & Lt., pf.—$7—no par	104½	101½	106½
National Pwr. & Lt., com.†—no par.	23½	19½	23½
National Pub. Serv., 7% pf.	k95½	93	96
National Pub. Serv., 7% pfe., pf.	113	108	115
National Pub. Serv., A com. $1.60—no par	22	18½	22½
National Pub. Serv., B com.—no par	19	14	20
Nebraska Pwr., 7% pf.	i108½	106	108½
Nevada-Calif. Elec., com.	26½	24½	26½
New Brunswick Pwr., 7% pf.	55	....	....
New Eng. Pub. Serv., pr. ln. pf. $7..	99½	98½	101
New Eng. Pub. Serv., pf. $7.	95	95	97
N. J. Pwr. & Lt., 6% pf.	92	....	....
New Orleans Pub. Serv.—7% pf.	104	103	105
N. Y. & Queens Elec. Lt. & Pwr., 5% pf.	90	....	....
N. Y. Central Elec., 7% pf.	102	102	104
Newport News & Hampton Ry., Gas & Elec., 5% com.	109	....	....
Newport News & Hampton Ry., Gas & Elec., 7% pf.	109	....	....
Niagara Falls Pwr., 7% pf.—25.	28½	27½	29
Niagara, Lock. & Ont. Pwr., 7% pf.	111	110½	113
No. Amer., 6% pf.—50.	52	50	52
No. Amer., com.—10.	47½	45½	50½
No. Amer. Edison, $6 pf.—no par.	100½	96½	100½
No. Caro. Pub. Serv., pf.—$7—no par	95	93	97
Northeastern Pwr., com.	16½	15	18½
No. Indiana Gas & Elec., 7% pf. A.	104½	102	104
No. N. Y. Utilities, 7% pf.	104	103	105½
No. Ohio Pwr., com.—no par.	11	9½	13½
No. Ohio Trac. & Lt., 6% pf.	80	78	81
No. Ohio Trac. & Lt., 7% pf.	90	90	93
No. Ont. Lt. & Pwr., 6% pf.	k 89	84	90
No. Ont. Lt. & Pwr., 4% com.	74	73	78
No. States Pwr., 7% pf.	104½	100½	104½
No. States Pwr., (Del.) 8% com.	113	109½	114
No. Texas Elec., 6% pf.	68	65	70
No. Texas Elec., 4% com.	39	27	36
OHIO BRASS, com. B $4—no par.	83	74	85
Ohio Brass, 6% pf.	100	100	103
Ohio Gas & Elec., 7% pf.	100	95	97
Ohio Pwr., 6% pf.	100	96	99
Ohio Pub. Serv., 6% pf.	k 94	95	96½
Ohio Pub. Serv., 7% pf.	104	103	105½
Ohio River Edison, 7% pf.	106	103	105½
Oklahoma Gas & Elec., pf.	98½	....	....
PACIFIC GAS & ELEC., 6% pf.	25	24½	26½
Pacific Gas & Elec., 8% new com.	32½	31	33
Pacific Pwr. & Lt., 7% pf.	i103	102	104
Parr Shoals Pwr., 6% pf.	92	....	....
Penn Cent. Lt. & Pwr., $5 pf.—no par ex. div.	c 72½	71½	72½
Penn-Ohio Edison, 7% pf.	100½	98	101½
Penn-Ohio Elec., 7% pf.	100	98	100
Penn-Ohio Pwr. & Lt., 7% pf.	101	99	102
Penn-Ohio Pwr. & Lt., 8% pf.	111	109	112
Penn Pwr.& Lt.—$7—no par.	i108½	107	108½
Penn. Pub. Serv., 6% pf.	87	....	....
Penn Wtr. & Pwr., 8% com.	e182	176	185
Phila. Co., 6% pf.—50.	51½	50	53
Phila. Co., com.—50.	106½	85½	110
Phila. Elec., 8% com.—25.	c 48½	....	....
Portland Elec. Pwr., 7% pf.	98	97½	100
Portland Elec. Pwr., 6% pf.	k 78	81	83
Portland Elec. Pwr., 6% 2d pf.	55	68	70
Portland Elec. Pwr., com.	20	28	30
Potomac Elec. Pwr., pf.	j108½	....	....
Pwr. Corp. of N. Y., com. $1—no par	m 79	....	....
Pwr. Sec., pf.—no par.	28	25	33
Pwr. Sec., com.—no par.	k 6	5	8
Public Serv. of Colorado, 7% pf.	k 99	99	99
Pub. Serv. of N. J., 7% pf.	113½	108½	115½
Pub. Serv. of N. J., 8% pf.	k127½	125	127½
P. S. of N. J., $5 com.—no par.	35½	32	35½
Pub. Serv. of No. Ill., 6% pf.	a105	....	....
Pub. Serv. of No. Ill., 7% pf.	a114½	....	....
P. S. of No. Ill., com. $8—no par.	k134	130½	136
Pub. Serv. of No. Ill., 8% com.	k133½	132	136
Pub. Serv. of Okla., 7% pf.	98½	99	100½
Pub. Serv. Elec. & Gas, 6% pf.	105	102	105½
Pub. Serv. Elec. Pwr., 7% pf.	k116	113½	116
Puget Sound Pwr. & Lt., 7% pf.	k107	105	107
Puget Sound Pwr. & Lt., 6% pf.	85	....	....
Puget Sound Pwr. & Lt., com.	28½	29½	33½
RADIO CORP. OF AMER., pf.—50.	52	50½	53
Radio Corp. of Amer., com.—no par.	48½	47½	50½
Republic Ry. & Lt., pf.	k120	....	....
Republic Ry. & Lt., com.	k122	112	135
Rochester Gas & Elec. 7% pf. B.	106	105	107
Rochester Gas & Elec., 6% pf. D.	103	101	103½
Rochester Gas & Elec., 6% pf. C.	103	101½	103½
SAFETY CABLE, com. $4.	61½	52½	64½
San Joaquin Lt. & Pwr., 7% pf.	107	105	108
St. Joseph Ry., L., H. & P., 5% pf.	70	70	73
Servel Corp.	7½	7½	10½
Sierra Pacific Elec., com.	24	....	....
Sioux City Gas & Elec., 7% pf.	101	....	101½
Southeastern Pwr. & Lt., pf.—$7 no par	j102½	....	....
Southeastern Pwr. & Lt., $6 pfc. pf.,	j 72½	....	....
Southeastern Pwr. & Lt., com.—no par.	32	29½	32½
So. Calif. dison, 8% pf.	36½	36½	38
So. Calif. Edison, 7% pf.	27½	27½	28½
So. Calif. Edison, 6% pf.	24½	24½	25½
So. Calif. Edison, 8% com.	33½	31½	34½
Southern Cities Utilities, 7% pf.	90	81	86
Southern Cities Utilities, com. $4.	38	....	....
Southwestern Lt. & Pwr., A $3.	63	60	65
Southwestern Lt. & Pwr., B.	63	60	65
Southwestern Lt. & Pwr., $6 pf.	86	83	86
Southwestern Pwr. & Lt., 7% pf.	k105½	103	105½
Springfield (Mo.) Ry. & Lt., 7% pf.	99	95	100
Standard Gas & Elec., 8% pf.	59½	57½	60
Standard Gas & Elec., 7% pf.	107½	103	106½
Standard G. & E., com. $3—no par.	56½	54	58
Standard Pwr. & Lt., 7% pf.	99½	98	100
Staten Island Edison, pf.—$6—no par.	101	99	101
Superheater, $6 com.—no par.	175	....	....
Syracuse Lighting, 7% pf.	105	103	107
Syracuse Lighting, 8% pf.	115	....	....
Syracuse Lighting, 8% com.	300	....	....
TAMPA ELEC., com. $2.	59	....	....
Tenn. Elec. Pwr., 6% pf.	92	92	94½
Tenn. Elec. Pwr., 7% pf.	105	103	106½
Terre Haute, Ind. & East. Trac., 5% pf.	20	20	25
Terre Haute, Ind. & East. Trac., com	1	1	3
Tex. Pwr. & Lt., 7% pf.	i108½	106	108
Tide Water Pwr., 8% pf.	105	105	108
Timken Roller Bear., com.—$4 no par.	85½	78	95½
Toledo Edison, 8% pf.	k115	115	118
Toledo Edison, 7% pf.	i105	104	105½
Toledo Edison, 6% pf.	k 95	95	97
Toledo Edison, 6% com.	k100	....	....
Tri-City Ry. & Lt., 6% pf.	93	90	97
UNITED GAS & ELEC., 6% pf.	99	98	99½
United Gas & Elec., com.—no par.	m 57	....	....
United Gas & Elec. (N. J.) 5% pf.	70	70	73
United Gas Impr., 8% com.—50.	c 94½	....	....
United Lt. & Pwr., pf.—$4—no par.	51	49	53½
United Lt. & Pwr., pf.—$6.50—no par.	90	87	93½
United L. & P., com A .48—no par.	13½	12½	15½
United L. & P., com. B .48—no par.	k 16	16	18
Utah Pwr. & Lt., 7% pf.	i 106½	104½	105
Utica Gas & Elec., 7% pf.	k105½	105	106½
Utica Gas & Elec., 8% com.	k200	....	....
Utilities Pwr. & Lt., 7% pf.	92½	93	98
Utilities Pwr. & Lt., com. A $2.	29½	27	30½
Utilities Pwr. & Lt., com. B $1—no par.	k 14½	13½	15½
VERMONT HYDRO-ELEC., 7% pf.	97	95	97½
Virginia Elec. & Pwr., 7% pf.	107	105	107
Virginian Pwr., 7% pf.	108	....	....
Virginian Pwr., com.	70	....	....
WAGNER ELEC., 7% pf.	b 75	....	....
Wagner Elec., com.†—no par.	b 22	....	....
Washington Ry. & Elec., 5% com.	j212	....	....
Washington Ry. & Elec., 5% pf.	j 91½	....	....
Washington Wtr. Pwr., 8% com.	140	136	140
West Mo. Pwr., 7% pf.	m92	....	....
West Penn Elec., 7% pf.	k106½	102	107½
West Penn Elec., Cl. A $7.	101½	97½	103
West Penn Pwr., 7% pf.	115	111	115
West Penn Pwr., 6% pf.	104½	100½	105½
West Virginia Lt., Ht. & Pwr., 7% pf.	93	94	96
West Va. Utilities, 7% pf.—50.	50	48	51½
Western Pwr., 7% pf.	98	98	101½
Western States Gas & Elec., 7% pf.	97	96	98
Western States Gas & Elec., com.	18	....	....
Westinghouse Elec. & Mfg., 8% com.—50.	76½	67½	76½
Weston Elec. Instrument, Cl. A $2.01—no par.	k 34½	30½	34½
Weston Elec. Instrument, com.—no par.	17½	15	18½
Wheeling Elec., 6% pf.	100	95	97
Wis., Pwr., Lt. & Ht., 7% pf.	k 95	95	97
Worthington Pump, 7% pf. A.	k 52	46	54½
Worthington Pump, 6% B.	44	40	45
Worthington Pump, com.	30½	20½	31½
YALE & TOWNE com. $5—25.	75	70½	75½

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid price Saturday, March 26. lBid price Wednesday, March 30. mLatest quotations available. †Dividend rate variable.

their stock, if such proposition is made, than they can hope to secure at the present time."

International Power Now in Control of Porto Rico Companies.—The International Power Company, which, as announced in the March 5 issue of the ELECTRICAL WORLD, issued debentures amounting to $3,000,000 for the purpose of acquiring the shares of the Porto Rico Railways Company, Ltd., is now in control of that company. The International Power Company is a Canadian holding company which owns a number of electric lighting, power and street-railway companies in Latin America and in the British colony of Newfoundland. It is controlled by the Royal Securities Corporation, Ltd., which company was the original promoter of the Porto Rico Railways Company, Ltd., and more than twenty years ago effected the consolidation of the different companies then engaged in the lighting, power and street railway business in San Juan, though it sold its interest in the Porto Rico company over twelve years ago.

New Capital Issue

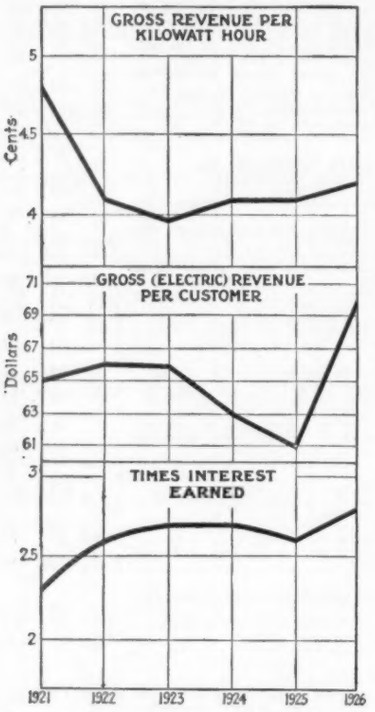
First mortgage gold bonds of the Washington Gas & Electric Company were offered to the amount of $1,750,000 during the last week in March, the price being 98 and accrued interest, to yield over 5.65 per cent. The Washington Gas & Electric Company furnishes electric light and power, gas and water service in the southwestern part of the State of Washington, headquarters being at Longview. These 5½ per cent sinking fund bonds were dated Feb. 1, 1927, and mature Feb. 1, 1947.

Commonwealth Power to Pay Extra Dividend.—Directors of the Commonwealth Power Corporation at a recent meeting declared an extra dividend of 50 cents per share on the common stock of the corporation payable May 2 to common-stock holders of record at the close of business April 7. At the same meeting of the board a resolution was adopted directing that common-stock holders of record at the close of business April 7 be offered the right to subscribe to additional common stock at $40 per share to the extent of one-tenth of their holdings at such record date, such subscription rights to expire at the close of business May 10.

New Jersey Utility Calls Stock.—The Public Service Electric Power Company has called for redemption May 1 all of its 7 per cent preferred stock at 115 and accrued dividends. This procedure marks one of the steps taken in the dissolution of this company following approval by the Public Service Commission of New Jersey of its absorption by the Public Service Electric & Gas Company.

Middle West Utilities Income Shows 25.8 per Cent Growth

A growth of 25.8 per cent in gross earnings of Middle West Utilities, of 42.7 per cent in subsidiary earnings and of 37.1 in earnings accruing to the parent from subsidiaries tells the story of the rapid progress of this important power and light group. The 1926 earnings on 435,736 shares of common amounted to $14.44 a share against $15.66 on the 272,433 shares in 1925.

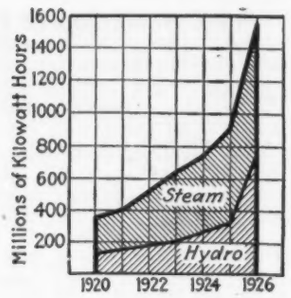


MIDDLE WEST UTILITIES SHOWS RAPID BUSINESS GROWTH

The company's business expansion was due to an aggressive business policy which resulted in the addition of many new customers and a substantial growth in sales to existing customers for a wide variety of uses. A growth of 56.3 per cent in sales of electric and gas labor-saving appliances is reported in the merchandising business of subsidiary companies. Electrical output increased 37 per cent and connected load 23 per cent. Last year the company sold 2,767 kw.-hr. per customer against 2,398 kw.-hr. four years ago.

Several of the subsidiaries carried on financing operations during the year with a view to improving their financial structures. These operations resulted in a reduction in fixed charges, improvement in the mortgage position of bonds and the facilitation of future financing by flexible mortgage provisions.

It is important that the purchase of new properties be taken into account in analyzing the year's growth. Early in the year the Southwestern Light & Power Company was purchased and later sold to the Central & Southwest Utilities, a subsidiary. The City Ice Company of Kansas City was acquired, and in addition several smaller companies were purchased by subsidiaries.



RELATIVE GROWTH IN STEAM AND HYDRO GENERATION

The company's subsidiaries are widely diversified, operating in nineteen states and in three distinct sections of the country. Evidence of strength resulting from this diversity of territory and of industries served is seen in the rapid growth of the company.

Central Stations Raise $485,000,000 in First Quarter of 1927

DURING the first three months of this year the electric light and power companies of the country raised $484,884,000 by the flotation of new securities, including stocks, bonds and debentures. This substantial sum represents public offerings only and does not include local sales to customers and employees. A total of $331,714,442 was recorded for the similar period of 1926, so that the first quarter of the current year draws to a close $153,000,000 in advance of the first quarter of 1926. January has been the banner month thus far, rolling up a score of $223,859,000. February receded to the $166,000,000 mark and in March new issues slumped to $95,025,000. The yield trend is interesting to follow. In January the new offerings yielded 5.45 per cent while in February they netted an average yield of 5.69 per cent. A downward trend appeared in March, when only 5.21 per cent was realized by investors.

Twelve individual companies contributed to the March total of $95,025,000, the most substantial sum being raised by the Georgia Power Company —a forty-five-million-dollar issue in the form of first and refunding mortgage gold bonds priced at 97 to yield 5.18 per cent. Refunding operations continued to play a prominent part in March's activities as they did in the preceding month. The new financing in March was almost exclusively long term.

Security Issues of Electric Service Companies in March

Name of Company	Amount of Issue	Period Years	Class	Purpose	Interest Rate	Price	Per Cent Yield
Public Service Electric & Gas Co.	$19,800,000	38	First and refunding mortgage gold bonds.	To purchase new plant and for refunding purposes.	5	99	5.06
National Public Service Corp.	2,150,000	..	Common stock, class A.	Expansion, improvements and for other general corporate purposes.	..	21¼	7.40
Commonwealth Edison Co.	15,000,000	30	First mortgage collateral gold bonds, series D.	To partially reimburse company for capital expenditures made.	4½	96	4.75
Long Island Lighting Co.	2,000,000	..	Cumulative preferred stock.	Additions, extensions and improvements.	6	100	6
Southern Ohio Public Service Co.	2,100,000	30	First mortgage gold bonds, series C.	Refunding.	5½	96½	5.75
	625,000	10	General mortgage convertible bonds.	To reinburse company for expenitures on additions and improvements and for other corporate purposes.	6	97	6.40
Central Public Service Corp.	750,000	15	Collateral trust gold bonds, series A.	For acquisition of properties, to retire indebtedness and for other corporate purposes.	6	97	6.30
United Power & Light Corp.	1,000,000	20	First mortgage gold bonds, series B.	Additions to plant and new capital.	5	96	5.30
Georgia Power Co.	45,000,000	40	First and refunding mortgage gold bonds.	To retire bonds of predecessor companies and to reimburse for expenditures incurred for construction and for other corporate purposes.	5	97	5.18
American Utilities Co.	1,250,000	18	First lien and refunding gold bonds, series A.	To pay for certain properties recently acquired by subsidiaries, for construction, for the retirement of notes and for other corporate purposes.	6	100	6
	350,000	14	Additional gold debentures.	.....	6½	96½	6.88
Utah Power & Light Co.	2,000,000	17	Additional first mortgage gold bonds.	Refunding and to reimburse for expenditures made for extensions and additions to property and for other corporate purposes.	5	98	5.18
Texas-Louisiana Power Co.	1,000,000	19	First mortgage gold bonds, series A.	To acquire properties and to reimburse the treasury for expenditures made for improvements and extensions.	6	100	6
Mississippi Power Company	2,000,000	28	First and refunding mortgage gold bonds.	To reimburse treasury for expenditures made for the acquisition of properties, construction and for other corporate purposes.	5	96	5.27
Total	$95,025,000						

Manufacturing and Markets

Strengthening Engineering Salesmanship

Suggestions on Eliminating Weak Points in Relations with Purchasers and Prospective Purchasers—Value of Good Methods and Personal Efficiency

ALL engineers are salesmen of one product or another, but in discussing the "sins" of salesmen in relation to the buyer and prospect, it should be recognized that these faults, while not universal, are frequent enough to deserve attention. Listed in numerical order these are:

1. Lack of complete knowledge of equipment. Many salesmen do not possess a full understanding of what their equipment is good for, all it is good for, and, especially, what it is not adapted to accomplish. A thorough understanding of these points is vital in dealing with technically competent clients. Sometimes the salesman has very hazy ideas of how apparatus and material are manufactured, and even the principles of operation are not always fully grasped. Another important matter is how a particular device or piece of equipment co-ordinates with other products. In this connection collateral knowledge is valuable to the salesman of technical products and should be more assiduously cultivated. How the equipment differs from alternative equipment or the products of competitors should be known as a matter of course, but defections in this direction are still frequently encountered. No argument should be required as to the need of knowing dimensions, weights, costs (erection and operation), and another great help to successful salesmanship is an understanding of how the championed product can be modified and adapted to unusual conditions.

2. Lack of knowledge of equipment used with the seller's product. This lack grows out of a narrow grasp of application problems and of a too limited comprehension of the relations of co-ordinated material and apparatus in a complex structure like a generating station, for example. A far better recommendation can be made in offering a specific type or unit of equipment for service if this offer is based upon a sound and liberal understanding of the interlock between the proposed application and related material and machinery.

3. Inability to furnish data on the spot, including prices on standard equipment. Annoying and needless delays which increase the cost of work often arise from this cause. The prospective buyer and his representative do not expect the salesman to quote prices on a bank balance basis or to present technical data correct to the last tenth of 1 per cent in the early stage of negotiations; but it is greatly desired that the salesman shall be equipped to give approximate information on standard lines of product as soon as the information is sought.

4. Promising deliveries which cannot be met. No extended discussion of the evils of this practice should be necessary. The reaction from carelessness or deliberate misquotation in this line is sure to be bad; it injures the salesman's reputation, and in the long run costs the buyer excessively. In large enterprises the element of overhead costs is so important that the salesman should strive to the utmost to keep within the bounds of practicability in setting down delivery dates. Habitual disregard of accuracy in this branch of his work ultimately undermines the confidence of his clientele in him and may lead to complete failure of his career.

5. Trying to sell "apples" for bananas." Sometimes salesmen attempt to secure orders for substitute material or apparatus which by no stretch of engineering can be made to take the place of the desired product. If the equipment offered cannot be suited to the purchaser's needs, the salesman should withdraw from the competition. It is the old story of trying to substitute a drug claimed to be "just as good" for another which cannot be properly duplicated in quality and applicability to the case in hand.

6. Inadequate backing of salesman by his company. This situation is a hard one for the salesman and buyer alike. Given a competent sales representative, the support of his organi-

Value of Electrical Exports for February, 1927, Compared with Corresponding Month in 1926

(Issued by Bureau of Foreign and Domestic Commerce)

Articles	February 1926	February 1927
Generators:		
Direct-current:		
Under 500 kw.	$48,858	$37,923
500 kw. and over	13,853	38,671
Alternating current:		
Under 2,000 kva.	9,766	13,624
2,000 kva. and over	330,376	175,258
Steam turbo-generator sets	89,479	30,100
Accessories and parts for generators	49,584	48,165
Self-contained lighting outfits	79,351	114,548
Batteries:		
Flashlight batteries	113,277	169,796
Other primary batteries	126,630	161,617
Storage batteries	301,340	242,931
Transforming or converting apparatus:		
Power transformers	105,704	114,816
Other transformers	56,977	138,317
Rectifiers, double current and motor generators, dynamotors, synchronous and other converters	74,359	75,104
Transmission and distribution apparatus:		
Switchboard panels, except telephone	249,450	49,880
Switches and circuit breakers over 10 amp.	186,372	117,990
Fuses and fuse blocks	34,787	18,714
Watt-hour and other measuring meters	39,567	16,149
Volt, watt and ampere meters and other recording, indicating and testing apparatus	115,322	174,512
Lightning arresters, choke coils, reactors and other protective devices	40,252	61,167
Motors, starters and controllers:		
Motors under 1 hp.	132,643	161,886
Stationary motors:		
1 to 200 hp.	211,502	204,576
Over 200 hp.	35,395	14,639
Railway motors	139,179	84,642
Electric locomotives:		
Railway	321,928	20,920
Mining and industrial	155,557	29,139
Starting and controlling equipment:		
For industrial motors	109,930	92,534
For electric railway and vehicle motors	4,020	4,180
Portable electric tools	33,506	70,188
Accessories and parts for motors	185,726	157,910
Electric appliances:		
Electric fans	111,221	74,515
Electric lamps:		
Metal filament	110,999	95,615
Other electric lamps	24,553	23,793
Flashlights	169,433	202,606
Searchlights and projectors	29,510	23,397
Motor-driven household devices	$88,621	$153,003
Domestic heating and cooking devices	136,434	113,956
Industrial electric furnaces and ovens	5,903	28,675
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc.	121,016	139,569
Signal and communication devices:		
Radio apparatus:		
Transmitting sets and parts	2,271	17,039
Receiving sets	172,910	203,367
Tubes	97,022	67,718
Receiving set components	105,281	150,817
Receiving set accessories	166,719	129,295
Telegraph apparatus	59,587	88,160
Telephone apparatus:		
Telephone instruments	22,864	28,702
Telephone switchboards	8,468	127,870
Other telephone equipment	176,935	183,091
Railway signals, switches, and attachments	18,970	60,846
Bells, buzzers, annunciators and alarms	18,011	18,347
Other electric apparatus:		
Spark plugs, magnetos and other ignition apparatus	121,947	126,646
Insulating material	92,807	97,389
Metal conduit, outlet and switch boxes	87,628	85,068
Sockets, receptacles and lighting switches	119,967	149,354
Electric lighting fixtures, interior and street	107,718	119,322
Other wiring supplies and line material	77,577	81,822
Other electric apparatus, not elsewhere stated	422,233	624,639
Rubber and friction tape	15,713	30,507
Globes and shades for lighting fixtures	43,569	50,456
Electrical glassware except for lighting	44,441	24,012
Electrical porcelain:		
For less than 6,600 volts	35,206	58,200
For 6,600 volts and over	36,025	30,393
Carbons, carbon brushes and electrodes:		
Electrodes for electric furnaces	93,019	93,415
Other carbon products	111,828	140,888
Insulated wire and cable (iron and steel)	11,268	10,718
Copper, bare wire	106,152	202,321
Copper, insulated wire and cable	399,402	346,540
Refrigeration sets up to 1 ton capacity	.....	161,515
Total	$6,967,918	$7,003,48

nation is so essential to successful business relations with the factory and the customer that nothing can take its place.

7. Use of "talking points" instead of facts about the product. Inexperienced salesmen are tempted sometimes to fall back upon this practice, but obviously the reiteration of talking points does not often fool purchasers of engineering equipment. The remedy is clear.

8. "Knocking" competitors. Far less of this practice is evident today than years ago, but now and then it is indulged in to the serious injury of the salesman. Constructive emphasis upon points of superiority is a very different thing from claims that rival products are "no good."

9. Annoying persistence at the wrong time. Tactless pursuit of the purchaser when he is not ready to determine his course or is absorbed in pressing affairs hampers not a few salesmen in their efforts to succeed. The sense of when to arrive and when to depart is invaluable. There is no place for "foot-in-the-door" methods in engineering salesmanship.

10. Failure to follow up orders placed. Loss of interest by the salesman in orders after the purchaser has "signed up" not only hampers the completion of the work in the field in many cases, but also hurts the reputation of the salesman with the customer. Reasonable service should form a part of all engineering sales activities, and this includes a permanent interest in the buyer's plant and its work.

11. Effort to use influence or "pull." Unless modern equipment and material are applied on an engineering and economic basis, no certainty of a satisfactory solution of the purchaser's problems can be had. Friendship is useful in reducing wastes of time in negotiations, in speeding up understandings of situations, and in creating confidence, but sound business decisions are made today upon other factors. "Wire pulling" creates a very bad impression among engineers.

12. Crying over lost orders. Good sportsmanship is essential to modern sales effort. Keen disappointments are inevitable when contracts are lost, but these disappointments should be borne as cheerfully and concealed as manfully as other defeats and sorrows of greater weight. Few indices of personality are as telling as the manner in which misfortunes are faced.

13. Inability to draw clear freehand sketches. Lack of this hampers many negotiations in the language of the engineer. The importance of being able to explain principles and propositions through sketches can scarcely be exaggerated.

14. Lack of interest in small orders in good times. Such an attitude needs no comment. The bad chickens hatched out by this policy (?) come home to roost when depressions are prevalent. No first-class salesman ever attempts to "high-hat" small orders.

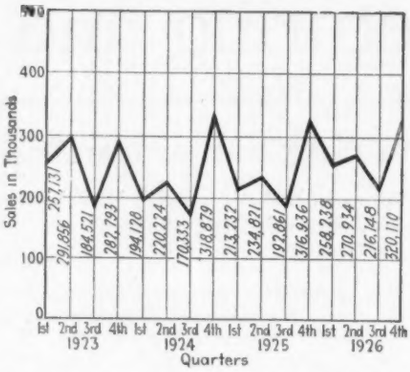
15. Wasting time on irrelevant matters. The pressure today is so great upon successful men in the engineering field that a sense of the value of time should never be lost by salesmen. Human contacts have their place, but these must be consistent with a scrupulous regard for business during business hours. Equally guilty is the purchaser who allows time to be wasted.

16. Failure to submit proposition in desired form. An enormous amount of foreign business has been lost by American manufacturers on this account, and in domestic business the burdens arising from the failure of salesmen to present bids on the requested basis are very heavy. Frank discussion of bid forms before preparation has its place in many negotiations, but in many others the reasons for asking for information in stated ways are good and sufficient from the purchaser's viewpoint, and salesmen should make it clear to their offices and headquarters that such requests should be heeded even at extra cost.

Turning from the above outline of weaknesses in modern sales engineering, the essential points of ideal salesmanship personnel may be summarized. These can be put in a very few sentences. Such a man is one who has faith in the equipment he is selling and faith in the company for which he works. That he has the latter's backing goes without saying. He "knows his stuff" from A to Z and can tell it, not tomorrow or next week, but "right now." He knows how his equipment fits in with other products. He will call quickly when necessity demands, and he always tells the facts about the delivery situation. No attempt is made by him to sell his equipment for service to which it is unsuited, he wastes no time "knocking" competitors, gives facts and not talking points on the construction and operation of his product, and after he tells his story he gets out.

If such a salesman gets the order, he follows it up to see that it is delivered on time and operates satisfactorily, and if he loses the order he "takes his licking like a man and digs in for the next one."

Vacuum Cleaner Sales



Vacuum cleaner sales by quarters during 1923, 1924, 1925 and 1926. (Data supplied by Vacuum Cleaner Manufacturers' Association.)

Building Sales Through Contract Distributors

Quotas Maintained by Frequently Furnishing Amount of Purchases to Buyer

ONE method used by a manufacturer in maintaining *esprit de corps* among his contract distributors consists of sending each of them a letter containing a report of their purchases for a given period. The letter gives the purchases made for the last month, the purchases from Jan. 1 to date, the purchases for the same period in the previous year, the quota for the year and the percentage of purchases for the period as compared with the quota for the same period.

This manufacturer has found that even in the case where a distributor has

FORM No. 1

June 25, 1926.

____ ____,
Philadelphia, Pa.

Gentlemen: Below is a report of your purchases on ____, and wish to assure you that this report is given only in the spirit of co-operation in helping you analyze your sales:

Bulk purchases month of May only	$ 690.82
Bulk purchases Jan. 1 to May 31..	2,859,27
Bulk purchases same period last year	1,587.45
Gross amount Jan. 1 to May 31...	2,859.27
Quota for year 1926	4,500.00
Percentage for first five months..	152

The above high percentage places you in sixth place among the eighty-odd distributors in the New York office territory.

Congratulations—fine work!

Very truly yours,

____ ____.

FORM No. 2

June 25, 1926.

____ ____,
Scranton, Pa.

Gentlemen: Below is a report of your purchases on ____, and wish to assure you that this report is given only in the spirit of co-operation in helping you analyze your sales:

Bulk purchases month of May only	$ 260.12
Bulk purchases Jan. 1 to May 31..	684.08
Gross amount Jan. 1 to May 31...	761.98
Bulk purchases same period last year	228.11
Quota for year 1926	1,500.00
Percentage for first five months...	121

Congratulations—fine work!

Very truly yours,

____ ____.

FORM No. 3

June 25, 1926.

____ ____,
Boston, Mass.

Gentlemen: Below is a report of your purchases on ____, and wish to assure you that this report is given only in the spirit of co-operation in helping you analyze you sales:

Bulk purchases month of May only	$ 685.20
Bulk purchases Jan. 1 to May 31..	1,285.50
Gross amount Jan. 1 to May 31...	1,329.96
Quota for year 1926	4,000.00
Percentage to date	80

Fine showing so far, but a little spurt on the part of your salesmen will put you over the top.

Very truly yours,

____ ____.

FORM No. 4

June 25, 1926.

____ ____,
New Haven, Conn.

Gentlemen: Below is a report of your purchases on ____, and wish to assure you that this report is given only in the spirit of co-operation in helping you analyze your sales:

Bulk purchases month of May only	$ 36.40
Bulk purchases Jan. 1 to May 31..	259.01
Gross amount Jan. 1 to May 31...	277.01
Quota for year 1926	1,500.00
Percentage to date	44

What can the writer do to help improve your present percentage?

Very truly yours,

____ ____.

reached or passed his quota he is able frequently to help the distributor and remove the obstacles which may be in his way. By this method the manufacturer evinces to the distributor that there exists a real desire on his part to help build sales.

Four types of letters, as reproduced on page 736, were used. Form No. 1 was sent to the first ten distributors having the highest percentage to date since Jan. 1; form No. 2 was sent to the distributors having a percentage of 100 or over, not including the first ten; form No. 3 was sent to the distributors with a percentage greater than 80 but under 100, and form No. 4 was sent to distributors with a percentage of less than 80.

Business Conditions

THE industrial activity prevalent on the entire Pacific Coast is the one really bright spot to be found in this week's survey of business conditions the country over. The fact, however, that not a few negotiations are pending lends substance to the hope that a bigger volume of business is in early prospect. Line materials appeared in good demand in the New England district. Extensions to existing power lines and the hooking up of new substations are furnishing opportunities for negotiation on large amounts of materials. Small-motor sales were characterized by a considerable volume of single orders, one manufacturer reporting the receipt of more than a thousand. Conditions in the New York district appear very quiet, with sales of transformers inactive, transmission-line materials dull and orders for switching equipment much decreasod in volume. With power-company business only fair and contracting and dealers' lines quiet, a contrast is afforded by the excellence of industrial orders on the Pacific Coast, especially in machinery and power apparatus.

Small orders continue to characterize what activity there is in the Southeast, with some promise, however, of a brisker pace in the near future. Utility companies' buying was the feature of an otherwise rather uneventful week in the Middle West, and what business of any nature there was originated in the Chicago district principally. In the St. Louis territory some good-sized contracts for central-station equipment are pending which it is expected will be closed within the next week. Aside from these prospects, little of immediate interest can be reported from this district, where business in general has been decidedly quiet.

Metal Markets Continue in a Quiescent State

All of the non-ferrous metals have had an uninteresting week, with buyers for the most part keeping under cover and not responding even when producers were willing to shade prices. Demand for copper has been slightly better than last week, but this is all that can be said for it; zinc demand was less, and lead and tin show little change so far as volume of business is concerned.

Copper was generally available for Eastern deliveries by Monday at 13¾ cents and continued at that price. In the Middle West as low as 13.20 cents, delivered, has been paid. The volume of business has been somewhat greater than last week, but is still much below normal. The total of March sales will be the lowest in months, so the prospect of a good buying wave in the coming week, or possibly in the week after next, seems excellent. Such a wave now seems likely to start at 13¾ cents or 13 cents unless the ranks of the sellers show unexpected weakness. The large producers have so far consistently refrained from forcing copper on the market; the depression in price is attributable to the custom smelters who make a policy of selling current intake. Following recent sales, they are perhaps in somewhat improved position.

NEW YORK METAL MARKET PRICES

	Mar. 23, 1927 Cents per Pound	Mar. 30, 1927 Cents per Pound
Copper electrolytic	13.25	13¾
Lead, Am. S. & R. price	7.55	7.45
Antimony	12¼	12¼-½
Nickel, ingot	35	35
Zinc spots	7.00	6.875
Tin, Straits	68¾	68¾
Aluminum, 99 per cent.	26	26

Base copper price March 23, 1927, 15¼ cents.

Business in New York Territory Somewhat Dull

Few central-station orders of any importance have been reported in the New York district recently, and many manufacturers say that conditions are very quiet. Transformers are inactive, sales being limited principally to distribution sizes, and one manufacturer reports sales this month to have fallen considerably below the level of previous months. Poles, cross-arms and line hardware are dull, individual orders in all cases being small. Orders for switching equipments have decreased, although some inquiries are being received and orders for this equipment aggregating about 10,000 kw. are expected to be placed soon. The demand for transformers for industrial applications is good, and motors of from 3 hp. to 10 hp. find a ready market. Sales of control equipment, too, are increasing, and manufacturers report an improvement in this line over last month.

Line Materials in Good Demand in New England

Wire, poles, cross-arms and line hardware are active in the New England market for electrical supplies and prospects of early construction exist. Line extensions and the linking up of new substations furnish a number of projects which are open for negotiations on considerable quantities of materials. Wire orders are being received in good number with prices close. In the past week one for more than 200,000 lb. was received, with others of less amount following. Small switches and safety appliances and control are active. One manufacturer reports overtime work to meet business at hand; another records many orders for single switches in good volume. Industrial equipment orders have slumped during the past week and negotiations dropped in volume. Small-motor sales are marked by a large number of single orders rather than by striking totals. One manufacturer reports over a thousand single orders, while another records orders for about 900 motors. The average weekly volume aggregates about $50,000, which is less than that of this time last year. Street-lighting projects are being closed and contracts will soon be let for a number of extensions. The activity in this line, however, is reported less than last year. Jobbers report little change in the demand for scheduled materials. Electric refrigerators are the most active of appliances and sales are gathering momentum.

Excellent Industrial Business on Pacific Coast

While power-company business is fair and business of contractors and dealers is rather quiet, industrial business on the Pacific Coast is excellent, particularly in machinery and power apparatus. Some interesting orders include 25 oil-well motors, 15 flow meters, 40 subway transformers for Oakland street lighting (value $30,000) and five large-size motors for irrigation (value $25,000). An outstanding order covers the electrification of 18 miles of Sierra logging line, including two 60-ton, 1,100-kw., 1,500-volt locomotives, automatic substations, rail bonds and line material, totaling about $125,000. Power-company inquiries include a twenty-five-hundred-dollar lot of pole-line hardware for Bay region stock and 700 cross-arms and 3,000 line switches for Los Angeles. Pumping-motor sales are very late, but are improving. Other business includes 2,000 stand-lamp clusters for a fixture manufacturer, several socket stock orders for the same, and many good stock orders for dealers in large interior towns. City business is quiet, however.

In Seattle and the Puget Sound district sales to a public utility are reported of three 3,000-kva. transformers, several oil circuit breakers ranging in size from 400 amp. to 600 amp. and some switching equipment for 15,000-volt service. A 2,000-kw. turbine has been purchased by a Snohomish County lumber mill. Numerous individual orders for industrial motors (chiefly replacements or small additions) range from 1 hp. to 25 hp. It is reported that the Allis-Chalmers Manufacturing Company has secured the contract for furnishing 90 250-hp. motors, a 400-hp. synchronous motor, nine transformers totaling 2,400 kva., together with the necessary switching equipment for a five-hundred-thousand-dollar double-band lumber mill being built in Everett, Wash. A hundred-thousand-dollar contract for the electrical equipment of an electrolytic zinc plant near Kellogg, Idaho, is reported to have been secured by the General Electric Company. An order involving a 10,000-kw. bank of transformers, two 4,000-kw. synchron-

ous motor-generator sets, switching apparatus, control equipment and several motors ranging from 15 hp. to 40 hp. are recorded sold to an irrigation district by a Seattle firm.

Small Orders Still Mainstay of Southeast's Business

A much brisker activity than for some weeks past was noted in the Southeast in all branches of the electrical field last week. There were few large individual orders but a very healthy volume of small and moderate-size purchases. In the past two weeks orders of this sort from one power company have totaled $22,000 for distribution and small power transformers and $18,500 for poles, with wire and cable purchases totaling something over $7,000. The largest single order for cable reported last week was from Memphis for $5,000 worth of paper cable. Two interesting central-station orders placed recently were for $10,500 worth of condenser equipment and switchboard equipment amounting to $7,000. Sales of lightning arresters are beginning to show the usual spring activity, one power company having placed an order last week totaling $4,000.

Construction materials, both line and building, are reported in satisfactory volume, building construction materials being in much better demand than for some time past, with the demand spread about equally between industrial, commercial and residential building. One jobber reports two four-thousand-dollar conduit orders last week, one from a power company and the other for a commercial building job. Good orders are being received from the larger contractors and an encouraging increase is to be noted in purchases by the small contractors over the territory generally, though this latter activity is less apparent in Atlanta than in other sections of the territory.

Middle West Utility Business Better than Industrial

Generally, business in the Middle Western States is a trifle quiet, that in the northwestern section a little more so than that in the central districts. Industrial activity appears spotty in most sections, although around Chicago business is apparently better than elsewhere. Lack of building is being reflected in the electrical field. While a number of large projects are contemplated, actual building is slow. In contrast with the slower industrial activity, the utility companies are generally active. Considerable purchasing of apparatus is being done, and a large amount of line-extension and service-increase work is under way. Among interesting orders placed this week were those for 36 3,000-amp. disconnecting switches, four closed feed-water heaters with appurtenances, five draft-control regulators and 500,000 lb. of weatherproof wires and cables. Most appliances continue to sell in fair volume. Electric toasters have been featured with considerable success this month. Commodity prices are generally firm, although manufacturers of code wire are anxious to take on business and some concessions for large orders are being made.

The one active spot in the St. Louis district seems to be the rice fields of extreme southern Missouri and Arkansas. A number of medium-sized motors have been shipped into that region during the past week to drive centrifugal pumps for shallow-well pumping. Some very good-sized contracts for central-station equipment are pending which should be closed within a week. General electrical business in building and other jobbing lines has been quiet for the past week.

Activities of the Trade

Bailey Reorganization Acquires G. E. Flow-Meter Business

The flow-meter business and patents of the General Electric Company and the fluid meter and combustion control business and patents of the Bailey Meter Company have been acquired, since April 1, by a new organization which will also be known as the Bailey Meter Company. Payment for the flow-meter business and patents will be made to the General Electric Company in stock of the new company, of which the other principal holder will be the Babcock & Wilcox Company of New York.

The engineering, manufacturing and sales organizations of the old Bailey Meter Company will be retained by the new company, with the increase in personnel necessary from the General Electric Company to handle the additional business properly. The new company will have its factory and general offices in Cleveland. E. G. Bailey, president of the old Bailey Meter Company, will be president of the new company; R. S. Coffin, vice-president of the old Bailey Meter Company, will be vice-president in charge of administration and finances, and R. E. Woolley, now connected with the General Electric Company, will be vice-president in charge of engineering and sales. The new Bailey Meter Company will offer its customers a complete line of flow meters, boiler-room instruments and combustion-control equipment.

Canadian Power Specialty to Make Power-Plant Equipment

A new company which will concentrate on the manufacture of power-plant equipment has been formed in Canada and has purchased the plant of the former Engineering & Machine Works of Canada, Ltd., at St. Catharines, Ontario. The new corporation will be known as the Canadian Power Specialty Company, Ltd., with main offices at the works and sales offices in Ottawa, Toronto, Montreal, Moncton N. B., and North Bay, Ontario. G. R. Cottrelle of the Canadian Bank of Commerce, Toronto, and G. B. Greene of the General Supply Company of Canada, Ltd., Ottawa, were chiefly responsible for the formation of the new company and for arrangements under which it is to manufacture and sell Foster power-plant equipment in the Dominion.

In addition to Foster superheaters, economizers, waterbacks, furnace surfaces and tubular oil stills, the line includes "Aero" unit coal pulverizers. The plant at St. Catharines includes foundry, pattern shop, machine shop, boiler shop, erecting shop, office, etc., and has a steady trade of pulp-and-paper-mill machinery and special machine work to meet the requirements of manufacturers without their own shops. The plant is on the Welland Canal and is served by two railway sidings.

Goodwin, Nicholas & Morton Organize as Marketing Counselors

Announcement is made of the organization of Goodwin, Nicholas & Morton, with offices at 522 Fifth Avenue, New York, to render service as marketing counselors in the electrical and allied industries. The officers of the corporation are: William L. Goodwin, president; Frederic Nicholas, vice-president and treasurer, and Walter H. Morton, vice-president and secretary. Mr. Goodwin retired recently from the Society for Electrical Development after six years as its operating vice-president. Through his long experience as a jobber on the Pacific Coast and his varied activities in other fields he has had intimate contact with the marketing problems of industry for many years and is nationally known for his constructive work.

Mr. Nicholas was formerly general secretary of the Associated Manufacturers of Electrical Supplies and executive secretary of the Electrical Manufacturers' Council. He was executive secretary of the National Electrical Manufacturers' Association during the period of organization of that association. Previous to this connection of nearly seven years with the electrical manufacturers' organizations, he was with the McGraw-Hill Company and predecessor companies for thirteen years, mainly as associate editor of the ELECTRICAL WORLD and the *Electric Railway Journal*. Mr. Morton, who recently sold his interest in the Sanborn Electric Company of Indianapolis, of which he had been treasurer for the past five years, has had a wide experience in both the retail electrical and contracting field and in organization work. He was one of the organizers and for many years manager-secretary of the National Association of Electrical Contractors and Dealers, now the Association of Electragists International, and served as secretary of the National Knit Goods Manufacturers' Association, the Porto Rico Fruit Exchange, the Utica Park Board and the Employers' Association of Utica, N. Y. Goodwin, Nicholas & Morton say they are equipped to serve both individual clients and groups of

clients in different branches of industry, either nationally or locally, in the solution of problems relating to the marketing of their products or service.

Fuller-Lehigh Company Acquires Part of Bailey Meter Business

The portion of the business of the Bailey Meter Company pertaining to pulverized-coal feeders, burners and water-cooled furnace walls has been taken over by the Fuller-Lehigh Company, Fullerton, Pa., since April 1, according to an announcement made by the companies. Grouping this equipment with the pulverizing mills, dryers, conveying systems, feeders and burners, the Fuller-Lehigh Company is now able to offer complete equipment, not only of pulverized-coal apparatus from the preparation plant to the furnace, but for the construction of the furnace as well. The Bailey water-cooled furnace wall, which has been applied to various types of furnaces, will still be available for stoker, gas and oil as well as pulverized-coal-fired boilers. The Fuller-Lehigh Company states that it will complete the contracts for furnace walls and other similar equipment now on order with the Bailey Meter Company and that all of this work will be carried through on the same schedule and with substantially the same personnel as in the past.

The sales organization includes E. J. Billings, vice-president in charge of sales; H. G. Barnhurst, H. R. Collins, A. P. Hachtmann, W. O. Renkin, and D. H. Mayo, formerly with the Ford Motor Company. Branch offices will be operated as follows: Boston, H. H. Leathers; New York, H. B. Jones, C. R. McClure, formerly manager Bailey Meter Company, New York office, and F. A. Scheffler, who will continue as special representative; Pittsburgh, W. R. Little, formerly with the Bailey Meter Company; Cleveland, L. W. Marso; Chicago, W. E. East, formerly with the Bailey Meter Company, and H. D. Lehr; St. Louis, F. C. Brandt, formerly with the Bailey Meter Company; Salt Lake City, W. Z. Harrison; and San Francisco, G. C. Barnaby. The engineering staff includes: J. B. Gaffney, chief engineer; L. W. Heller, formerly general engineer of the Bailey Meter Company in charge of the Furnace-Wall division, is assistant chief engineer; A. G. Kinyon, consulting engineer on pulverized-coal-transport systems; Ralph Galt, chief service engineer; C. A. Maxwell, until recently with Day & Zimmermann, superintendent of construction, and R. M. Hardgrove, formerly research engineer of the Bailey Meter Company, research engineer.

The Lamson Company, Inc., Syracuse, N. Y., announces that the Lamson "Ice Maid" refrigerator will be distributed in St. Louis by the Weber Implement & Automobile Company, pioneer automobile distributor for twenty years, now handling Hupmobile and Studebaker cars. The territory covers nineteen counties surrounding St. Louis and including parts of Illinois and Arkansas. Sale of the franchise to the Weber company is in keeping with the Lamson policy of discontinuing most factory branches. The Weber company is installing showrooms throughout its territory.

The Artistic Lighting Equipment Association announces that its office has been moved from Cleveland to New York City and is now at Room 711, Graybar Building, 420 Lexington Avenue.

The General Electric Company through its merchandise department has launched an extensive cleaner campaign, which has been so planned and prepared for the dealer that it becomes only necessary for him to put it into effect.

The Silvray Company, Inc., 55 West Sixteenth Street, New York City, is now marketing a portable lamp recently developed that is used to "daylight" offices, factories, shops and homes. It embodies the Silvray indirect lighting principle, a reflecting mirror being permanently silvered on the bulb, which is a standard daylight blue bulb.

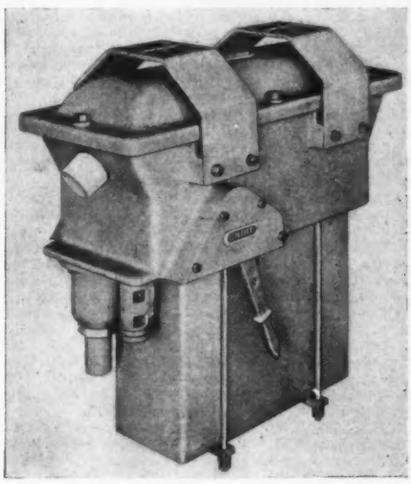
The Benjamin Electric Manufacturing Company, 120 South Sangamon Street, Chicago, announces that P. A. Powers has been appointed sales manager of its refrigeration division and that R. W. Staud succeeds Mr. Powers as advertising manager.

The Superior Iceless Refrigerator Company, Hanna Building, Cleveland, is arranging for the early removal of its plant from Wapakoneta to Canton, Ohio, where it recently acquired the former plant of the Gilliam Roller Bearing Company. That structure will be remodeled and improved, and additional equipment will be installed to care for increase in output.

New Equipment Available

Oil Circuit Breaker

A manually operated pole-top oil circuit breaker known as type PK-9, especially designed for outdoor distribution for all voltages up to 7,500, has been placed on the market by the Condit Electrical Manufacturing Corporation, Boston. This breaker is said to be of sturdy construction throughout. The top casting which houses the mechanism and supports the stationary current-carrying members with their insulators is designed with its sides sloping inward. This feature of the design makes it possible to mount the bushings in such a manner that rain and moisture will drain off externally to the breaker and in addition will provide facilities for the usual drip loops on incoming and outgoing leads.



POLE-TOP OIL CIRCUIT BREAKER FOR 7,500-VOLT SERVICE

The tanks are of strong rectangular construction supported by a strong bolt construction and protected by the overhanging of the top castings. The breaker is furnished for automatic or non-automatic operation. For automatic operation a bushing-type current transformer is furnished and also a trip coil.

A position indicator external to the breaker is provided so as to determine whether the breaker is in the open or closed position. The breaker is furnished in one-pole, two-pole and three-pole design for 400, 600 and 800-amp. capacity at 7,500 volts, with an estimated interrupting capacity of 3,000 amp. at 7,500 volts.

Coil Winding Apparatus.—The Chapman compensating tensionless "dereeler" for use in connection with any armature-winding machine, and which it is claimed will unreel magnet wire under no tension, permitting of high-speed winding of armatures with enamel-covered wire, has been developed by P. E. Chapman, northeast corner Tenth and Walnut Streets, St. Louis. To wind phase or other coils with this device a winding form is substituted for the armature winding head. Coils made with this equipment, it is said, will retain their original shape, as twisting of the cotton covering is compensated for.

Stationary Tachometers.—A line of O-Z stationary tachometers with 6-in. dial has been placed on the market by the O. Zernickow Company, 15 Park Row, New York. These instruments are said to be free-running, dead-heat sensitive and accurate to within one-half of 1 per cent at any point of the scale. The operating principle is similar to the centrifugal pendulum construction as embodied in the O-Z hand tachometer. The standard range is from two to sixteen times the minimum speed either for revolutions-per-minute or feet-per-minute speeds. The instrument is made in two models, one with the hand mounted in the center and a circular graduation over the entire circumference of the dial, and the other with the hand mounted below the center and the dial having a semi-circular graduation.

New Trade Publications

SYNCHRONOUS MOTORS. — Bulletin GEA-708 issued by the General Electric Company, Schenectady, N. Y., describes and illustrates the "G-E" types TS (three-phase) and QS (two-phase) "7600 Series" medium-speed synchronous motors for general-purpose application.

RELAYS.—The Roller-Smith Company, 233 Broadway, New York City, has issued supplement No. 1 to bulletin No. 550, covering its type "FR" relays for alternating current and direct current, designed for use in connection with contact-making instruments, meters and similar devices.

CONDUIT FITTINGS. — Catalog No. 2,100 issued by the Crouse-Hinds Company, Syracuse, N. Y., describes the various types of its new "Obround" condulets and wiring devices. Illustrations are given showing the method of construction and applications of the "Obround" condulets.

SLUICEGATES.—The Coffin Valve Company, Neponset, Mass., has issued section 1 of its general catalog in which it gives descriptive and dimensional information, recommendations and sample specifications of the Coffin standard sluicegates. The catalog contains complete information concerning the sluicegates that the company furnishes, in what size they are made, how they are constructed and how they should be operated. Photographs showing various types of installations are included in the catalog.

CONNECTORS.—A leaflet issued by the Burndy Engineering Company, Inc., 10 East Forty-third Street, New York City, describes and illustrates the Burndy shrink-fit and soldered type connectors for high-tension conductors.

COPPER-CLAD STEEL.—The Copperweld Steel Company, Braddock, P. O. Rankin, Pa., is distributing a leaflet containing a description of the process of manufacture of "Copperweld" and the method of determining the adequacy of the protective coating.

TROUBLE FINDER.—The Davis Emergency Equipment Company, 67 Wall Street, New York City, is distributing a leaflet describing the Davis trouble finder, designed for locating defects in transmission lines or equipment.

ELECTRICAL REFRIGERATION. — "The Magic of Frost Crystals" is the title of a booklet issued by the Lamson Company, Syracuse, N. Y., in which it describes and illustrates the Lamson "Ice Maid" method of electrical refrigeration.

ELECTRIC MOTORS.—The Master Electric Company, Linden and Master Avenues, Dayton, Ohio, is distributing a folder entitled "Performance That Bears the Spotlight of Investigation," calling attention to the various uses of the Master motors.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase is desired in Cologne, Germany (No. 24,683), of storage batteries.

An agency is desired in Essen, Germany (No. 24,747), for storage batteries.

Purchase or agency is desired in Caen, France (No. 24,746), for electrical appliances.

An agency is desired in Amsterdam, Netherlands (No. 24,730), for small electrical appliances.

An agency is desired in Buenos Aires, Argentina (No. 24,729), for electric signs, fans, heating appliances, and dry-cell batteries.

An agency is desired in Stockholm, Sweden (No. 24,739), for electric fountains.

An agency is desired in Sydney, Australia (No. 24,728), for electrical household appliances, and electrical refrigerators.

Purchase and agency are desired in Prague, Czechoslovakia (24,725), for insulating material.

An agency is desired in Hamburg, Germany (No. 24,726), for insulating material.

Purchase is desired in Antwerp, Belgium (No. 24,776), of electric kitchen ranges and ovens.

Purchase and agency are desired in Durban, South Africa (No. 24,724), for electrical refrigerators.

An agency is desired in Asuncion, Paraguay (No. 24,727), for electrical refrigerators.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

CANTON, MASS.—The Edison Electric Illuminating Company of Boston, it is reported, is taking bids for an addition to its power plant at 47 Revere Street, to cost about $40,000.

HAMDEN, CONN.—A permit has been granted the United Illuminating Company, New Haven, to erect a substation at 909 Whitney Avenue.

Middle Atlantic States

BELLPORT, N. Y.—Permission has been granted the Patchogue Electric Light Company to construct an electric light plant in Bellport and to exercise a franchise granted by the Village Board.

INLET, N. Y.—The Inlet Utilities Corporation, recently organized, has applied to the Public Service Commission for authority to construct an electric plant in Inlet to furnish electricity to residents along Fulton Chain. The cost is estimated at $16,600.

OSWEGO, N. Y.—Contracts have been signed between the Water Service Commission of Oswego and the Oswego River Power Corporation for the leasing and the development of the city's power rights at Dam No. 6 in the Oswego River for a period of 25 years at an annual rental of $50,000, the plant to be built by the company and turned back to the city at the expiration of the lease. The new plant will cost about $850,000 and will develop about 7,500 hp.

POUGHKEEPSIE, N. Y.—The Central Hudson Gas & Electric Company has applied to the Public Service Commission for permission to extend its transmission lines to serve electricity in the towns of Newburgh, Ulster and Marbletown.

SCHENECTADY, N. Y.—Plans are under way by the Adirondack Power & Light Company for a local service and equipment building, to cost about $200,000.

JULIUSTOWN, N. J.—The Eastern New Jersey Power Company has authorized the erection of a transmission line from Jobstown to Juliustown for local service.

CONOWINGO, MD. — Permission has been granted the Conowingo Electric Light & Power Company, a subsidiary of the Philadelphia Electric Company, by the Public Service Commission to extend its transmission lines in Harford County to furnish electricity in that territory.

THAYER, W. VA.—Plans for extensions to the local mines of the Berwind-White Coal Company include electric power plant and the installation of electrical machinery, etc.

PETERSBURG, VA.—The City Council plans to install an improved police and fire-alarm system.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, until April 5, for lighting and power wire for the Brooklyn, Boston, Norfolk, Portsmouth and other navy yards (Schedule 6988).

WASHINGTON, D. C.—Bids will be received by the General Purchasing Officer, Panama Canal, until April 14, for electrical equipment, including telephone cable, rubber insulated wire, copper railway signal wire, etc. (Panama Circular 1792).

North Central States

DETROIT, MICH.—Plans have been filed by the Detroit Edison Company for the construction of a local substation to cost about $300,000.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until April 8, for repairs to stacks at Fairmount and Kirkland Stations and municipal light plant and lightning protection for Kirkland station for the Department of Public Utilities.

CLEVELAND, OHIO.—An expenditure of $1,100,000 has been authorized by the Ohio Public Service Company for the erection of 45 miles of 132-kv. double-circuit steel-tower transmission line between Sandusky and Toledo, with switching and transformer substations. This work includes additions to the company's present substation at Sandusky. The new line will tie into the 60-cycle system of the Toledo Edison Company.

COLUMBUS, OHIO.—The Ohio Utilities Company plans extensions during 1927, to its high-tension lines, substations and distribution lines.

DAYTON, OHIO. — Extensions contemplated by the Dayton Power & Light Company during 1927, include an expenditure of about $1,000,000 on its distribution system; $750,000 on stations, substations, etc.

TOLEDO, OHIO.—Power substations and distribution lines, to cost about $1,500,000, will be built by the Toledo Edison during the coming year.

LOUISVILLE, KY.—The Board of Public Works plans to install an ornamental lighting system on a portion of Jefferson Street, and intersecting thoroughfares.

HOWE, IND.—The Board of Trustees, Howe Military School, it is understood, will soon ask for bids for the construction of a power plant, at the institution, to cost about $50,000. Charles R. Weatherhogg, 250 West Wayne Street, Fort Wayne, is engineer.

RICHMOND, IND.—Bids will be received by the Board of County Commissioners until April 9, for an electric refrigerating plant.

CHICAGO, ILL.—Bids will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until April 14, for improvements and extensions at the United States Marine Hospital, Chicago, including the modernization of the mechanical equipment of the buildings, extension to power house, miscellaneous repairs, etc.

DECATUR, ILL.—Application has been made to the Illinois Commerce Commission by the Illinois Power & Light Corporation, Chicago, and the Central Illinois Public Service Company, Springfield for authority to erect a 33,000-volt transmission line from Decatur to Assumption for interconnection of power service between the two companies. Within the city it will form part of a loop line erected to serve more adequately the east side industries.

BERLIN, WIS.—The Wisconsin Power & Light Company, Madison, plans to erect a transmission line between Mackford and Green Lake Center, 11 miles long, to furnish service to farmers in that district.

DE FOREST, WIS. — The Wisconsin Power & Light Company, Madison, plans to rebuild its local substation and distribution system.

FLORENCE, WIS. — Extensions and improvements contemplated by the Peninsular Power Company, Milwaukee, during 1927, include the erection of a 66,000-volt transmission line, 14 miles long, from the Twin Fall hydro-electric plant to Point River, to cost $80,000, and another line (66,000 volts) between Point River to Stozer, thence to Crystal Falls and the Rogers mine, to cost $55,000.

KOHLER, WIS.—Bids will be received by the City Council until April 9, for 60,000 ft. of single conductor cable, for the municipal lighting system. The Jerry Donohue Engineering Company, Sheboygan, is engineer.

MILWAUKEE, WIS.—The East Side Business Men's Association has petitioned the City Council for the installation of a new ornamental lighting system in the downtown section of the city.

MILWAUKEE, WIS.—The County Board is considering the construction of a power plant to supply electricity and heat for the new court house and public safety building or purchasing the service from the Milwaukee Electric Railway & Light Company.

MONROE, WIS.—The Wisconsin Power & Light Company, Madison, plans to erect a number of rural lines this spring and summer to serve farmers in this district.

RACINE, WIS.—The City Council has approved the petition of the downtown merchants for the installation of a new ornamental lighting system on Main and Sixth Streets. Plans are also under consideration for the installation of ornamental lamps on Franklin, Howe and North Main

Streets, from Goold Street to the city limits.

MELROSE, MINN.—The Miracle Mills Company is planning to remodel its mill and build a new power plant. J. H. A. Brahtz, 212 Builders Exchange Building, St. Paul, is engineer.

DUBUQUE, IOWA.—Bids will be received by the Public Dock Board, City Hall, until April 18, for electrical work at the municipal dock and terminal. Walter F. Schultz, Shrine Building, Memphis, Tenn., is consulting engineer.

SIOUX CITY, IOWA.—Plans have been filed by the Chicago, St. Paul, Minneapolis & Omaha Railway Company, 522 Nebraska Street, for the construction of a generating station at Fifteenth and Wall Streets.

STANHOPE, IOWA.—The City Council is considering an issue of $15,000 in bonds for the erection of a transmission line from Stanhope to Webster City, for local service.

ASH GROVE, MO.—At an election held recently the citizens voted to sell the municipal electric distributing system to the Empire District Electric Company, Joplin.

ST. LOUIS, MO.—Director of Public Utilities Pritchard of St. Louis has estimated that more than $2,500,000 will be required above the $8,000,000 voted in 1923 to complete the street-lighting system. If no more money is voted it will be necessary to abandon the installation of electric lamps in two large areas of the city. One between West Florissant Avenue and Natural Bridge Avenue from the river to the western city limits and the other from Bates Street south between the river and the western city limits.

LAKOTA, N. D.—Negotiations have been completed by Drake-Jones & Company, Minneapolis, for the purchase of the electric plant of Lakota Light & Power Company. Extensive improvements are contemplated by the new owners.

LOUP CITY, NEB.—The Nebraska Electric Company, Davenport, Iowa, has applied to the Public Service Commission for permission to erect a transmission line from Loup City to Arcadia.

OMAHA, NEB.—Extensions and improvements are contemplated by the Nebraska Power Company of Nebraska, Omaha, to its system in the northeastern part of the state, to cost about $500,000.

VENANGO, NEB.—The City Council is considering the erection of a transmission line from Venango to Grant, about 18 miles, to furnish electricity for local service.

MANHATTAN, KAN.—The State Legislature has approved an appropriation of $325,000, for a power plant at the local Kansas State Agricultural College. The Board of Regents, State House, Topeka, will be in charge.

PLAINS, KAN.—The municipal electric plant has been acquired by Dwight Chapin, Jr., of Wichita. Local service will be supplied by a high-tension line from Copeland.

ROCK, KAN.—Steps have been taken by residents of Rock to secure the erection of a transmission line (3½ miles long) to connect with the transmission lines of the Kansas Gas & Electric Company, Wichita.

Southern States

HIGH POINT, N. C.—Plans for rebuilding the plant of the Hill Veneer Company, recently destroyed by fire with a loss of about $125,000, include a power house.

ALBANY, GA.—Bonds to the amount of $10,000 have been voted for enlarging the municipal electric light plant, and $12,000 for extensions to the street-lighting system.

ATLANTA, GA.—Work will soon begin by the Georgia Power Company on the erection of a 44-000-volt, three-phase transmission line from Wrightsville, 25 miles long. This line will pass through Kite, where a 2,300-volt, three-phase distributing system will be built.

SANDERSVILLE, GA.—The Georgia Portland Cement Corporation, Augusta, is planning to build a power plant at its local cement mill. The H. K. Ferguson Company, Euclid Avenue, Cleveland, Ohio, is engineer.

PENSACOLA, FLA.—The City Council contemplates the installation of an ornamental lighting system on the Pensacola-Flomaton Highway covering about 45 miles. Frank J. Jarrat, City Hall, is city engineer.

PENSACOLA, FLA.—The MacMillan Mill Company, 525 North Lee Street, contemplates the construction of a hydroelectric power plant on the Pine Barren River, near Pensacola, to cost about $150,000. Emmett S. Killebrew, Albany, Ga., is engineer.

CHATTANOOGA, TENN.—J. H. Street, Times Building, and associates are planning to build an ice and cold storage plant, to cost about $150,000.

KINGSPORT, TENN.—Plans are under way by the Carolina Power & Light Company, Raleigh, N. C., for the erection of a transmission line from Waterville to Kingsport, to connect with the system of the Appalachian Electric Power Company.

KNOXVILLE, TENN.—Plans for the proposed local cement mill to be erected by the Volunteer Portland Cement Company, recently organized by J. Ross Hanahan, 21 Meeting Street, Charleston, S. C., and associates, to cost about $1,000,000, include a power plant.

MEMPHIS, TENN.—Plans have been filed by the Memphis Power & Light Company for the construction of a substation at 422 North Dunlap Street, to cost about $50,000.

NASHVILLE, TENN.—Bids will be received by the United States Engineer, Nashville, until April 5, for two turbo electric generators (Circular 353).

FLORALA, ALA.—The Gulf Electric Company, Troy, which recently acquired the municipal electric plant, plans extensions to its transmission lines in this section.

STEVENSON, ALA. — The Southern Cities Power Company, Chattanooga, plans to erect a 44,000-volt transmission line from Stevenson to Sherwood, Tenn., about 19 miles long.

JACKSON, MISS.—The program of the Mississippi Power & Light Company for 1927, involving the erection of 350 miles of 110-kv. lines, together with smaller lines and substations, to cost approximately $11,000,000.

WATER VALLEY, MISS. — The installation of a 300-hp. Diesel engine and generator in the municipal electric and water plant, to cost about $40,000, is under consideration by the City Council.

ARKADELPHIA, ARK.—The Arkansas Power & Light Company, Pine Bluff, plans to rebuild its local substation recently damaged by fire, with a loss of about $17,000.

LITTLE ROCK, ARK.—The Arkansas Light & Power Company contemplates an expenditure of $3,000,000, during 1927 for extensions and improvements to its system.

STERLINGTON, LA.—Plans are under way by the Louisiana Power Company to increase the output of its power plant to 150,000 kw. The company is operated by the Arkansas Light & Power Company, Pine Bluff, Ark.

LAWTON, OKLA.—Plans are under way by the Southwestern Light & Power Company for the erection of a 66,000-volt transmission line, 40 miles long, connecting the central stations at Chichasha and Lawton. The company has also begun work on a 66,000-volt line from Chichasha to Hinton.

PURCELL, OKLA.—Extensions and improvements to the municipal electric light plant are under consideration by the City Council, to include a 500-hp. Diesel engine driven generating unit, etc. The cost is estimated at $60,000. R. W. Calloway is engineer.

CROWELL, TEX.—Plans are under way by H. E. Ferguson for the construction of a hydro-electric plant, near Crowell, to cost about $100,000.

DALLAS, TEX.—The installation of 350 additional street lamps to be placed in various parts of the city has been approved by the City Commissioners.

DEL RIO, TEX.—The Texas Central Power & Light Company, San Antonio, plans to build a dam and hydroelectric plant on Devil's River, near here. The proposed plant will have an initial capacity of 6,000 hp. and transmission lines will be extended to a number of towns in this part of the state.

MOUNT VERNON, TEX. — The East Texas Public Service Company, Marshall, plans to build a cold storage plant here, to cost about $40,000.

NIXON, TEX.—Plans are under way by T. A. Closlitzer, New Braunfels, who recently purchased the local electric plant, for extensions and improvements to the local system, to cost about $60,000.

SAN ANTONIO, TEX.—Extensions to the transmission system of the Central Power & Light Company in south Texas to be made this year will include the erection of 127 miles of additional 60,000-volt pole lines. An 80-mile line from Victoria to Sinton, through Goliad, Beeville and Skidmore. A high-tension line, 38 miles long, will also be built in Jackson and Wharton Counties, in the rice growing sections.

Pacific and Mountain States

SEATTLE, WASH.—Plans have been filed by the Municipal Lighting Department for the construction of a substation at Eighth Avenue, N. E., and Seventy-fifth Street.

ALHAMBRA, CAL.—The City Council has approved the installation of an ornamental lighting system on portions of Norwood Place, Glendon Way, Front Street and Ross Avenue.

BERKELEY, CAL.—Plans for the proposed local factory of the H. J. Heinz Company, Northside, Pittsburgh, Pa., to cost about $300,000, includes power plant, ice and refrigeration plant.

BRAWLEY, CAL.—Plans are under way by the Board of Trustees, Imperial Irrigation District, for the construction of three hydroelectric plants in connection with an irrigation system, the stations to be located at the Rositas Dam, Alamo Dam and at No. 8 heading. The cost of the project including transmission lines is estimated at $1,500,000. M. J. Dowd is chief engineer.

LA VERNE, CAL.—Steps have been taken by the Chamber of Commerce for the installation of an ornamental lighting system the entire length of Third and Fourth Streets, between the city limits.

LONG BEACH, CAL.—The City Council has approved the installation of ornamental lamps on First Street using metal standards.

LOS ANGELES, CAL.—The installation of ornamental lamps on portions of Stanley and Croft Avenues, to cost about $25,000, is under consideration.

LOS ANGELES, CAL.—The City Council has approved the installation of ornamental lamps on portion of Rochester and Wellworth Avenues, using pressed steel standards.

OROSI, CAL.—Plans are under way by the San Joaquin Light & Power Corporation, Fresno, to build a new local substation to cost about $62,000.

PASADENA, CAL.—Plans have been authorized by the City Directors for a new 15,000 kw. steam-driven generating unit for the municipal electric plant. The cost is estimated at $612,000.

REDWOOD CITY, CAL. — The Pacific Gas & Electric Company, San Francisco, has appropriated $39,265, for line extensions and improvements in this section.

REEDLEY, CAL. — The San Joaquin Light & Power Company, Fresno, contemplates improvements to its local substation, to cost about $22,000.

SAN FRANCISCO, CAL.—The State Division of Water Rights has issued a permit to the Yosemite Power Company, San Francisco, for water rights on the Toulumne River, at Heardin. The company proposes to build an electric plant, to cost about $5,500,000.

BOISE, IDAHO.—The Idaho Power Company has applied to the Federal Power Commission for a license covering a transmission, about 81 miles long, connecting its plants at American Falls and at Shoshone Falls.

CEDAR CITY, UTAH.—The Dixie Power Company has applied to the State Engineer for the use of 4,000 ft. of water from Santa Clara River and Diamond Wash. The plans provide for a development of 2,000 hp. to be used in Iron and Washington Counties.

PHOENIX, ARIZ.—Plans are under way by the Salt River Valley Water Users' Association for the construction of a new dam at Stewart Canyon, to develop about 12,000 hp.

WINSTON, MONT.—The Montana-Idaho Mines Corporation, is planning to build a hydroelectric plant for service at its properties.

Canada

NIAGARA FALLS, ONT.—Plans are under construction by the Hydro-Electric Power Commission of Ontario, Toronto, for rural transmission lines in the Niagara district. The cost is estimated at $250,000.

MONTREAL, QUE.—The directors of the Ottawa-Montreal Power Company have authorized the erection of a high-tension transmission line from Calumet to Hull to connect with the systems of the Ottawa & Hull Power Company and the Ottawa River Power Company to secure power to meet the increasing demand for service in the Ottawa-Montreal territory.

Electrical Patents

Announced by U. S. Patent Office

(Issued March 8, 1927)

1,620,397. INCANDESCENT ELECTRODE DEVICE; C. Samson, Berlin, Germany. App. filed March 20, 1925. To facilitate the starting of the discharge from a non-operative condition in which the electrodes are not heated.

1,620,405. TELEMETRIC SYSTEM; G. W. Sprenger, Lynn, Mass. App. filed Oct. 6, 1925. Applicable to transmitting continuous movement or small intermittent movements. An impulse telemetric system capable of operating over a telephone circuit without interfering with speech.

1,620,428. WIRE-TERMINAL CLIP FOR TOY TRACKS; H. S. Becker, River Forest, Ill. App. filed April 25, 1925.

1,620,432. EMERGENCY HEATER; W. A. Brown, Philadelphia, Pa. App. filed July 23, 1925.

1,620,437. TRANSFORMER; L. H. Burnham, Pittsfield, Mass. App. filed April 14, 1925. Oil-immersed, water-cooled type with an improved arrangement of casing and cooling-pipe coils. The combination of a transformer with a casing adapted to contain a body of oil for immersion of the transformer, the casing comprising a lower portion containing the transformer and an upper portion overhanging the lower portion, and cooling-pipe coils in the overhanging part of the upper portion, the coils surrounding a central space of sufficient size to permit removal through it of the transformer without disturbing the coils, the lower-casing section being connected to the upper section by a separable joint and having its upper edge arranged to fit and receive a cover, whereby the lower section may be closed with the upper section and the cooling coils removed.

1,620,447. APPARATUS FOR MARKING INCANDESCENT LAMPS AND SIMILAR ARTICLES; J. F. Donovan, East Cleveland, Ohio. App. filed April 9, 1925. Machine adapted to print upon articles such as glass bulbs.

1,620,465. DISPLACEMENT-RESPONSIVE DEVICE; E. E. Johnson, Scotia, N. Y. App. filed Nov. 5, 1925. Responsive to the displacement angle of synchronous dynamo-electric machines.

1,620,483. AUTOMATIC ALTERNATING-CURRENT CUT-OUT DEVICE FOR POLYPHASE CIRCUITS; M. N. Mikulic, Kansas City, Mo. App. filed June 3, 1922. Will be operative to protect the motor or other electrical apparatus from being operated on less than the normal number of phases in the circuit.

1,620,487. FILAMENT SUPPORT FOR SERIES LAMPS; A. L. Powell, Bloomfield, N. J. App. filed Dec. 19, 1921.

1,620,496. IRON CONTACT RAIL WITH COPPER INSERT; K. Spieckermann, Dortmund, Germany. App. filed Aug. 28, 1926.

1,620,504. REGULATING APPARATUS; F. H. Winter, Schenectady, N. Y. App. filed Sept. 15, 1924. A regulating apparatus comprising a resistor having a plurality of contacts and a contact member adapted to engage the contacts, retarding means having a movable member arranged to co-operate with the contact member, electro-responsive means including an armature pivoted at one end and resiliently connected to the movable member at its other end, and means for biasing the contact member to a position in which it exerts upon the movable member a force tending to move the armature to its open position.

1,620,506. SYSTEM OF DISTRIBUTION; E. F. W. Alexanderson, Schenectady, N. Y. App. filed Nov. 1, 1924. System for converting direct current to polyphase alternating current.

1,620,518. FILM CUT-OUT; H. E. Butler, Scotia, N. Y. App. filed March 31, 1926. As used in series incandescent street lighting.

1,620,519. ELECTRICAL ABRASION PROCESS; M. S. Clawson, Upper Montclair, N. J. App. filed April 18, 1922. by means of which metallic surfaces may be smoothed or dressed.

1,620,528. GOVERNING MECHANISM FOR ELASTIC-FLUID TURBINES; W. L. R. Emmet, Schenectady, N. Y. App. filed May 8, 1923.

1,620,537. ELECTRICAL HEATER; C. C. Garey, Bremerton, Wash. App. filed May 15, 1926. For general application in the home.

1,620,548. LIGHTER FOR CIGARS AND THE LIKE; R. O. Hammond, Rochester, N. Y. App. filed Jan. 12, 1922.

1,620,552. ELECTRIC TRANSMISSION SYSTEM; E. H. Jacobs and C. F. Schoonmaker, Chicago, Ill. App. filed July 23, 1920. Installations and systems requiring a large flow of current. In combination an alternating-current conductor of high-current-carrying capacity, comprising a plurality of air-cooled, flat copper bars disposed in parallel relation, the bars being placed at the corners of a polygon with their flat sides vertical, said bars being of the same phase and being arranged in sections, and transposing connections for connecting the sections.

1,620,555. ELECTROMAGNETIC DEVICE FOR ALTERNATING-CURRENT CIRCUITS; B. W. Jones and N. A. Wolfe, Schenectady, N. Y. App. filed Nov. 12, 1921. Which will operate on a polyphase circuit in one direction at various speeds or upon a single-phase circuit in either a forward or reverse direction and at various speeds without change in the circuit connections.

1,620,556. ELECTROMAGNETIC DEVICE; B. W. Jones, Schenectady, N. Y. App. filed Nov. 12, 1921. For automatically opening a polyphase circuit upon the opening of one or more of its phases, and more particularly for opening the circuit to an electric motor operating upon a polyphase circuit to prevent the motor from running on less than the normal number of phases.

1,620.602. ELECTRIC COOKING DEVICE; B. Mayer, Baltimore, Md. App. filed July 21, 1926.

1,620,608. ELECTRIC MACHINE WITH SPLIT POLES; H. Papst, Vienna, Austria. App. filed May 25, 1926. Means for changing the location of the pole clearance of a split-pole motor to an unsymmetrical position with respect to the centers of the pole gaps, whereby the effect of the armature counter-ampere turns may be greatly diminished in the brush zone and the brushes operated in a favorable commutation field.

1,620,619. TRANSFORMER-VOLTAGE-REGULATING SYSTEM; P. M. Currier, Ballston Lake, N. Y. App. filed June 29, 1926. Whereby the voltage of a transformer may be regulated or adjusted without interrupting the load carried by the transformer.

(Issued March 15, 1927)

1,620,622. ELECTRICAL MEASURING INSTRUMENT; R. G. Arey, Worcester, Mass. With means whereby the movable indicating pointer may be readily adjusted with respect to the fixed calibrated scale of the instrument.

1,620,627. HEATING ELEMENT FOR ELECTRIC FIRES, RADIATORS AND THE LIKE; H. H. Berry and J. W. Reid, London, England. App. filed April 5, 1926. Of the kind comprising a rod or bat of insulating material having both longitudinal grooves and spiral or helical grooves of the two-start or double-thread type and into each of which a coiled resistance wire is placed, the wires being so connected to the source of electrical supply that one wire can be used alone or both can be used simultaneously.

1,620,693. TERMINAL INSULATOR; H. W. Royal, North Youngstown, Ohio. App. filed May 28, 1926. For electric motor terminals; especially designed and adapted for use in insulating the coupled terminals which serve to connect the motor leads with line wires.

1,620,745. ELECTRIC WATER HEATER; W. W. Wainwright, Tacoma, Wash. App. filed July 15, 1925. Primarily adapted for use in homes, restaurants, hotels and the like.

1,620,767. ELECTRIC HEATER; A. Johnson, Oakland, Cal. App. filed June 1, 1926. Portable heater designed for positioning within a room or enclosure and from all sides of which heated air is directed under pressure.

1,620,781. ALTERNATING-CURRENT RELAY; L. H. Peter, King's Cross, London, England. App. filed July 15, 1925. Of the induction type, in which the torque exerted upon the vane or other movable element of the relay is due to the co-operation of two magnetic fluxes traversing the vane or other element and generated by separate energizing windings to which alternating currents of suitable different phase are supplied. A relay which shall be unresponsive to alternating current of a predetermined frequency supplied to either or both of the relay windings, and effectively responsive to alternating current of another different frequency supplied to both windings, thus providing a two-element relay which is selective in operation as regards the frequency of the energizing current supplied thereto.

1,620,788. DEVICE FOR PASSING CABLES THROUGH PIPE LINES; J. M. Thompson and W. H. Thompson, Buffalo, N. Y. App. filed Dec. 10, 1925.

1,620,792. METALCLAD ELECTRIC SWITCH GEAR OF THE DRAW-OUT TYPE; W. Anderson, Hebburn-on-Tyne, and H. W. Clothier, Wallsend-on-Tyne, England. App. filed Feb. 4, 1926. Switchgear in which the sockets on the fixed portion of the gear are provided with doors or covers opened and closed automatically by the movement of the draw-out portion of the gear. These doors are hinged or pivoted, and when the drawn-out portion of the gear is racked in they are caused by the action of operating rods to fold together and slide into a space between two sockets—for instance, a busbar socket and a transformer socket—provision being made for a further racking in motion of the draw-out portion without further motion of the doors.

1,620,804. INSULATOR; S. C. Cutter, Oswego, Ill. App. filed Aug. 13, 1924. Adapted to be attached to the side of a tree trunk or limb.

1,620,806. THERMO-ELECTRIC SWITCH; F. S. Denison, Minneapolis, Minn. App. filed Dec. 10, 1923.

1,620,814. ELECTRIC SAFETY SWITCH; B. E. Getchell, Plainville, Conn. App. filed July 13, 1926. A switch construction having the fuses so located with respect to the blades and terminals that when the switch is open the fuses will be entirely disconnected from all associated electrical circuits so that there is no possibility of electrical shock while changing fuses, regardless of which terminals the line wires may be connected to.

1,620,828. HIGH-FREQUENCY VESICAL ELECTRODE; M. Molony, San Francisco, Cal. App. filed Jan. 2, 1926.

1,620,837. ELECTRODE-HOLDING DEVICE; R. P. Schrartz, Cincinnati, Ohio. App. filed July 6, 1926. For supporting a plurality of carbon electrodes from which rays are projected; for projecting rays at their maximum intensity on any desired object.

1,620,842. ELECTRIC HAND LANTERN; J. Van Rensselaer, Jr., Council Bluffs, Iowa. App. filed April 13, 1922. Suitable for use by railway trainmen and others engaged in occupations where it is desirable that the lantern he capable of use for signaling as well as for illumination in the immediate vicinity of the user.

1,620,878. ELECTROMAGNETIC DEVICE; G. W. Elmen, Leonia, N. J. App. filed Aug. 16, 1921. Having an electrical conductor disposed about a core comprising at at least two elements of the magnetic group, one of which is nickel, and having a higher permeability than iron for magnetizing forces of the order of a few tenths of a c.g.s. unit or less.

1,620,909. ELECTRICAL FIXTURE; M. K. Maxwell, Butte, Mont. App. filed Nov. 12, 1924. To provide illuminated ornamentation for the interior of an automobile or the like.

1,620,929. HEAT THERAPY METHOD AND MEANS; G. W. Wallerich, Chicago, Ill. App. filed Feb. 5, 1925.

1,620,951. CALL SWITCH FOR HOSPITAL-SIGNAL SYSTEMS; W. P. Crockett, Chicago, Ill. App. filed April 14, 1923.

1,620,963. LIGHTING FIXTURE; E. F. Guth, St. Louis, Mo. App. filed July 5, 1921. Inclosed lighting unit, adapted for controlling and varying the distribution and diffusion of the light rays within a certain determined radius on the working plane.

1,620,987. SYSTEM OF CONTROL BY IMPULSES OF PREDETERMINED DIFFERENT DURATIONS; A. D. Trenor, New York. N. Y. App. filed Aug. 12, 1920. A system for controlling from a distance in response to radiant or other impulses a main operative device and simultaneously controlling selectively any one of a plurality of operative devices.

1,621,006. POWER-FACTOR METER; R. S. Evans, Pittsburgh, Pa. App. filed Dec. 7, 1921. A device for measuring the power factor of a circuit upon which by reason of unequal load distribution, for example, unbalanced voltage conditions obtain.

1,621,011. MOTOR-CONTROL SYSTEM; A. L. Harvey and N. K. Anderson, Wilkinsburg, Pa. App. filed Feb. 20, 1923. To afford suitable protection to motors subjected to variations in load current on account of variable line voltage.

1,621,020. THERMAL RELAY; H. D. Matthews, Edgewood, Pa. App. filed Jan. 16, 1924. For electrical apparatus; comprising a bi-metallic member, one end of which is freely movable through a definite path.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

Primary Power Has Trebled in a Quarter Century

AN ESTIMATE of the total capacity of prime movers—waterwheels, steam engines and turbines, and internal-combustion engines—in public utility plants, manufactories, and mines and quarries (locomotives, motor vehicles and water craft not included) has recently been published by the Federal Power Commission. The total, as of Jan. 1, 1927, is given as 56,500,000 hp., an increase of 26,000,000 hp. since 1910 and of 544,000 hp., or about 5 per cent, during 1926. The rating has therefore almost doubled in sixteen years. In the past quarter century the increase has been more than threefold.

The two charts here reproduced are taken from diagrams prepared by R. W. Davenport of the commission and are based on information from various sources. It appears that on Jan. 1, 1910, waterwheels constituted 13.7 per cent of the total capacity of prime movers, and on Jan. 1, 1927, they constituted 20.7 per cent, showing not only an absolute but also a relative increase in water-power development.

For many years the increase in the use of water power was relatively slow. Notable activity commenced in the nineties, when the hydro-electric plant became a factor in the generation of power, and up to 1910 the rate of growth gradually increased.

The annual growth from 1910 to 1923 was fairly uniform, except possibly in the years 1913 and 1919, the former including the Keokuk and Big Creek installations, the latter a large additional installation at Niagara Falls.

The great increase beginning in 1923 is ascribed to several factors—increasing demand for power, reaction from retarded growth during the war, stabilization of construction costs and the passage, in 1920, of the federal water-power act.

The internal-combustion engine, though invented years before, also began to acquire significance as an industrial prime mover in the nineties. According to the chart, internal-combustion engines now constitute about 6-1 per cent of the total primary power.

Nearly three-fourths of the whole is in the form of steam engines and turbines. Adding the internal-combustion engine, it is seen that fuel-operated plants now account for practically four-fifths of the entire rating.

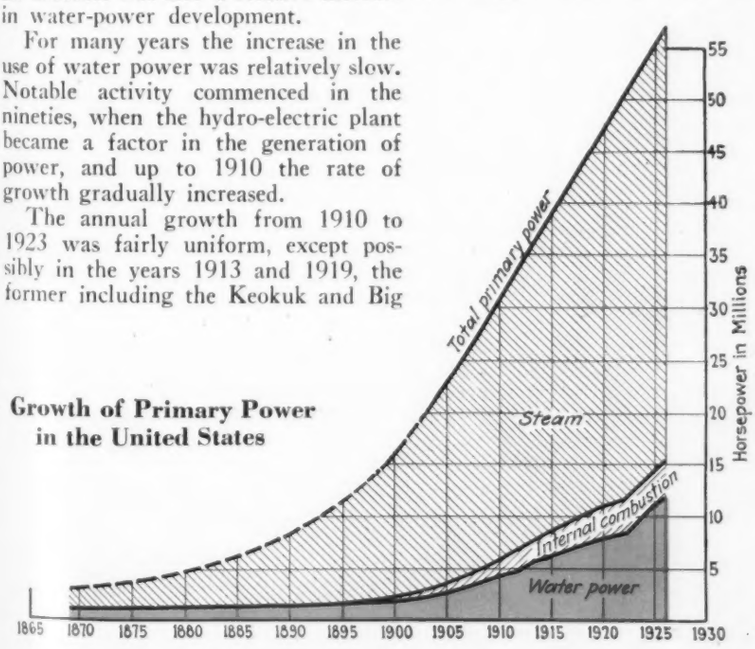
The chart for primary power indicates that power development in this country changed from a curved to a straight-line increase nearly twenty years ago. This is for power of all kinds. The electric utility output, by contrast, is still curving upward.

The generator capacity in public utility plants, railway as well as electric light and power, has recently been given as 25,256,556 kw. This corresponds approximately to 37,500,000 hp. of prime-mover installation and therefore represents quite closely two-thirds of the total.

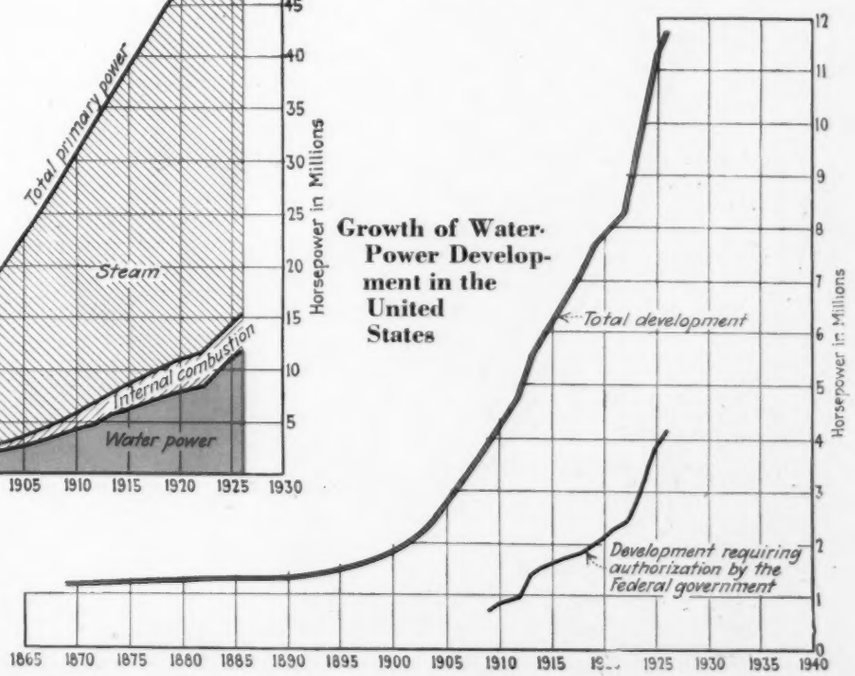
As the electrification of industry proceeds, and as new uses are found for electrical energy, the percentage in public utility plants should increase, and the growth curve of the electric light and power industry should therefore continue on its upward trend somewhat longer that that of the total primary power in all industries.

The proportion of the developed water power requiring authorization by the federal government is 4,130,000 hp., or 34.5 per cent, of which slightly more than one third is authorized under the federal water-power act.

Licenses now issued under that act provide for the development of 3,200,000 hp. in the next ten years. In addition there will continue to be new developments and increased installations at present developments not requiring federal authorization.



Growth of Primary Power in the United States



Growth of Water-Power Development in the United States

Most of the data for statistics in the *Electrical World* are gathered by it from original sources. Privilege is freely given to readers of the *Electrical World* to quote for use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the *Electrical World* in obtaining and compiling further basic information if those who make use of these statistics would give credit to the *Electrical World*.

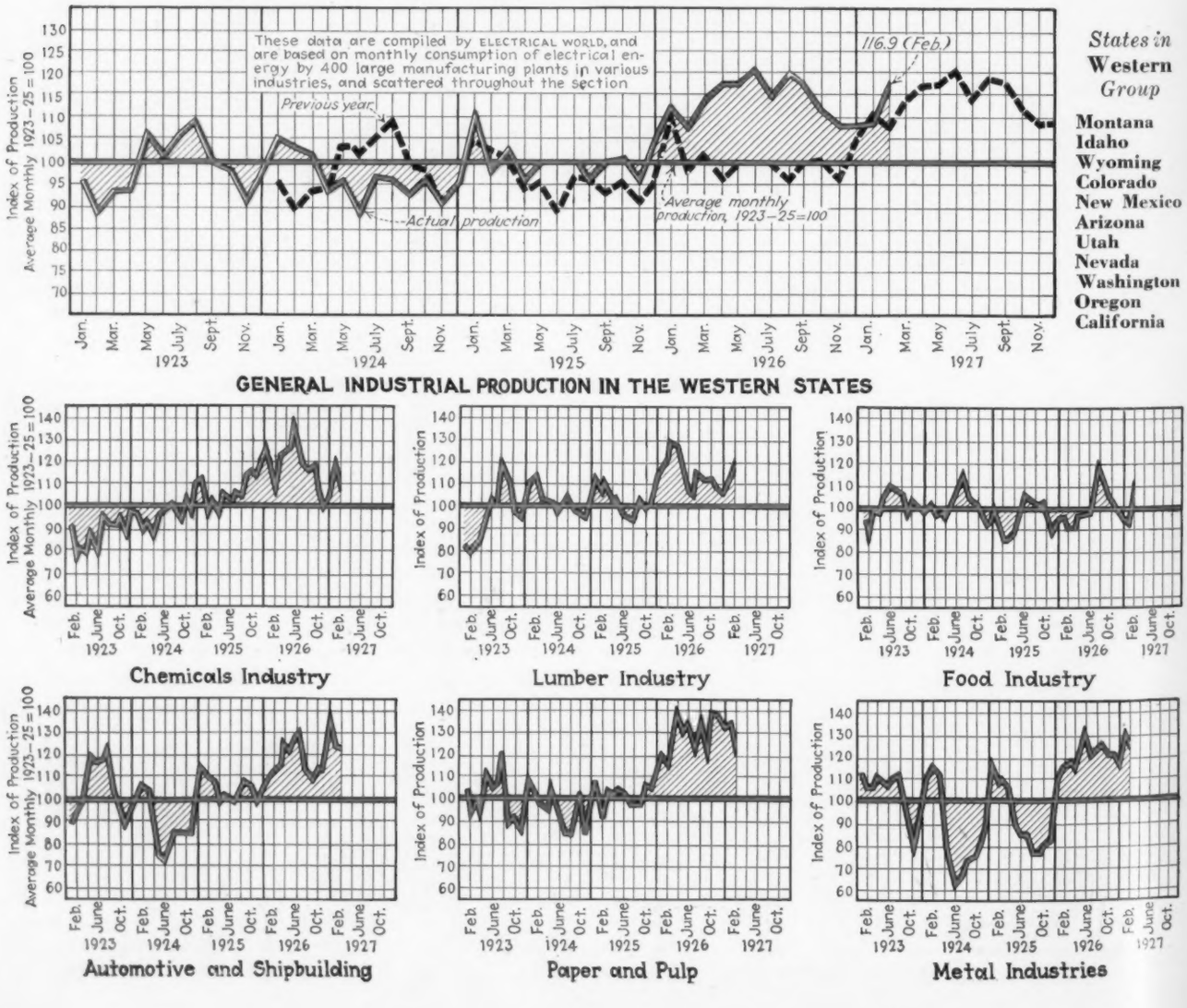
Western Production Over That of Last Year

WESTERN States bear the distinction of being the only section in the nation to report industrial production since the opening of the year on a plane higher than that reported for the same period of last year. A further distinction lies in the fact that the industrial production of these states has been above that for the same months of the previous year ever since February, 1925. What proportion of this increased production over the previous year has been due to a large natural expansion of industry in this section and what proportion to a temporary general economic condition is a fact not easy of determination. The fact remains, however, that the manufacturing plants taken as a whole in this section are experiencing a high degree of industrial activity materially above that which is being experienced in the eastern section of the nation.

Reports on the monthly consumption of electrical energy received by the ELECTRICAL WORLD indicate that January industrial production and February industrial production in the Western States were about 1 per cent and 9 per cent respectively above the production for the same months of 1926. All of the six leading primary industries of the section, with the exception of the chemical industry, reported February production above that of February last year, and two of these industries, lumber and food, reported actual production during February above that of January, notwithstanding the comparatively small number of working days. The weight given to these two outstanding industries of the section resulted in an increased composite figure over that of January.

Production in the food and kindred products plants was materially increased during February, the actual production during this short month being about 24 per cent above that reported for January and about 25 per cent over February of last year. This is a rather unusual upward trend in the activities of these plants, reports of previous years indicating that the first quarter of a year generally witnesses comparatively low rates of activity in this type of manufacturing.

A distinct upward trend in production is also reported by the logging and lumber industry, but reports of past years indicate that materially increased production is to be expected in the lumber mills at this season of the year. The production of lumber in this section during February was about 9 per cent over January, but was about the same as reported for February last year. There is no indication that the reported elimination of the housing shortage has been felt to any material extent by the lumber industry of the West.

"Electrical World" Barometer of Industrial Activity in the Western States

(Data Unadjusted for Seasonal Variation)